INDEX TO ADVERTISERS PAGE 62. CONTENTS PAGE 64.

THE FOUNDRY

Vol. 18. *CLEVELAND, OHIO, JUNE, 1901.* *No. 106.*

PUBLISHED MONTHLY BY
THE IRON AND STEEL PRESS CO.
ROSE BLDG., CLEVELAND, OHIO.

G. H. GARDNER, PRESIDENT AND TREASURER.
JOHN A. PENTON, VICE-PRESIDENT.
A. I. FINDLEY, SECRETARY.

JOHN A. PENTON. - - - - - - Editor.
HENRY HANSEN. - - - - - Associate Editor.

CHICAGO: 934 Monadnock Blk., GEO. H. GRIFFITHS.
PITTSBURG: 429 Park Bldg., A. O. BACKERT.
NEW YORK: 150 Nassau St., D. C. WARREN.

The subscription price of THE FOUNDRY is $1.00 a year to points in the United States, Canada and Mexico. $1.75 to all other countries.

THE FOUNDRY has but one advertising rate, which will be found printed in each issue.

Practical articles, pertaining to the trade in all its branches, are solicited and will be paid for.

We can begin subscriptions with the current number only.

Entered as second class matter at the Post-Office at Cleveland, Ohio.

Go to Buffalo.

Once a year the foundrymen are offered an opportunity to meet others engaged in the same trade. This year, June 4, 5, and 6 has been announced as the date and Buffalo, N. Y., as the place.

This is the sixth annual convention of the American Foundrymen's Association, the five previous meetings having been held at Philadelphia, Detroit, Cincinnati, Pittsburg, and Chicago. The coming assemblage at Buffalo promises to be the largest gathering of foundrymen ever witnessed. The selection of a place could not have been more appropriate, as Buffalo offers unusual attractions to visitors this year in the Pan-American Exposition, besides being a very central location and within easy reach of the great foundry centers.

It is not expected that the foundries of the country will be able to cease work for even a day as the majority of shops are engaged on urgent work, but the foundry foremen should be given a chance to exchange ideas with others holding similar positions, and this chance will be found at Buffalo. Those having direct charge of the foundries are generally kept in the shops six days in the week. Surely a day or two is not any too much of a vacation and the firm granting it will be the gainer.

The Buffalo foundrymen are ready to extend the glad hand to their fellow workers from far and near. Foundrymen, take a day and go to Buffalo.

Trade Outlook.

There are probably but few who realize that the manufacturing industries of the United States are passing through a period of activity which has never been equalled. There are more men working at higher wages and under better conditions than ever before and while every usual feature of a boom is absent manufacturers are prospering.

The consumption of all kinds of materials continues at a very high rate, and the absence of inflated values has added a stability to this activity which was unknown in the "rush order" days of two years ago. New work is being planned in every quarter and the building of new foundries and the enlargement of older plants are daily items of news.

Consolidations of interests affecting the foundry trade keep on being promoted. A transaction of considerable moment was carried through during the month of April, when the E. P. Allis Co., Milwaukee; Fraser & Chalmers, Chicago; Gates Iron Works, Chicago, and the Dickson Mfg. Co., Scranton, Pa., combined their interests under the name of the Allis-Chalmers Co., which will have a capital stock of $50,000,000. The following will constitute the board of directors: Edward D. Adams, New York; Charles Allis, Milwaukee; Mark T. Cox, Orange, N. J.; James H. Eckels, Chicago; Elbert H. Gary, New York; William A. Read, New York; James Stillman, New York; William W. Allis, Milwaukee; Frank G. Bigelow, Milwaukee; W. J. Chalmers, Chicago; Wm. L. Elkins, Jr., Philadelphia; Henry W. Hoyt, Chicago; Max Pam, Chicago; Edwin Reynolds, Milwaukee, and Cornelius Vanderbilt, New York.

An attempt is also being made to bring several of the great ship-building plants under one head. The names of the following industries are mentioned in connection with the project: The Newport News Shipbuilding & Dry Dock Company, The Union Iron Works of San Francisco, Cal.; The New London Shipbuilding Company of New London, Conn.; The Crescent Shipyards of Elizabethport, N. J.; The Bath Iron Works and the Bath Windlass Company of Bath, Maine. It is stated that the company is to be capitalized at $70,000,000, of which one-half is to be preferred stock. In order that outside influence may not obtain control, it is stated that no bonds are to be issued. According to reports, and inasmuch as the manufacturers have not enjoyed such credits in buying their materials, they say they have been placed at a disadvantage.

A Modern Foundry.

A foundry, completely equipped with labor saving devices, well lighted, properly ventilated, and arranged to produce a maximum quantity of finished castings with a minimum of labor, is the dream of the twentieth century foundryman.

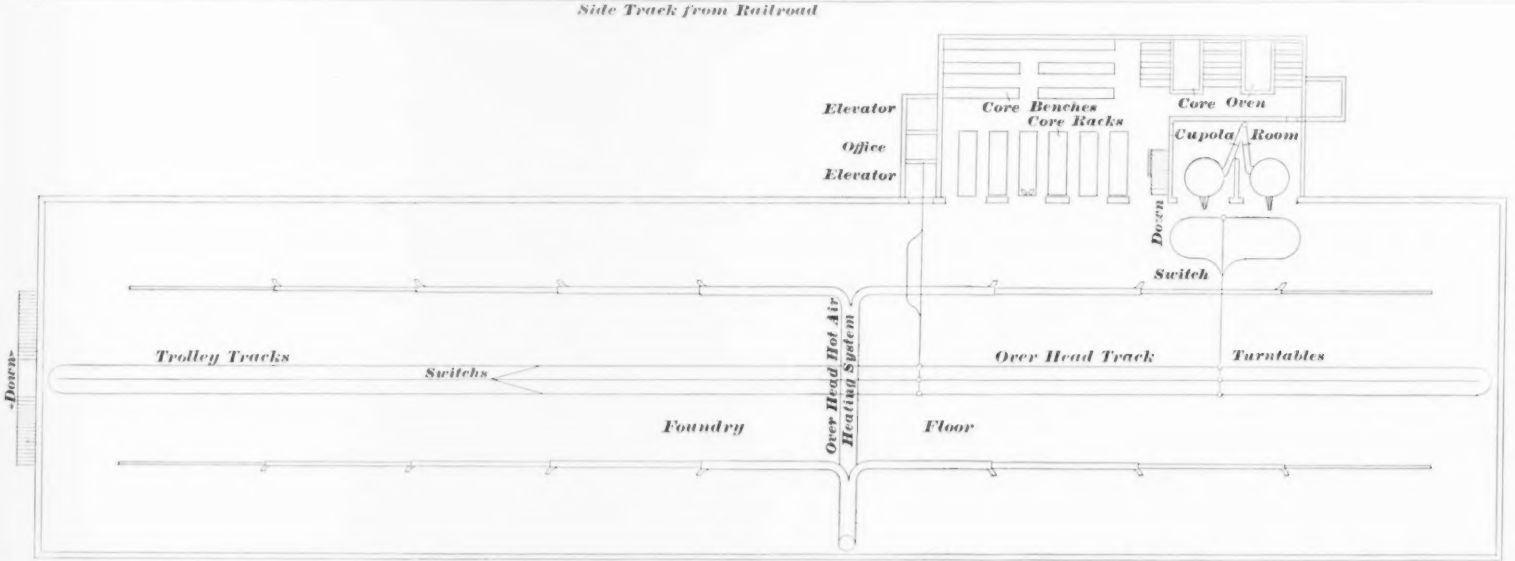
The ideal structure recently completed by the Milwaukee Harvester Co., of Milwaukee, Wisconsin, comes very close to the realization of such a dream.

THE FOUNDRY OF THE MILWAUKEE HARVESTER COMPANY, MILWAUKEE, WIS.

H. E. Huntington, a nephew of the late Collis P. Huntington, is to be the president of the company.

The plow manufacturers are another body that it is proposed to bring under a central organization. Aside from expected economies in manufacturing and the distribution of the finished product, the combination has for one of its purposes the elimination of long credits which have been given those who sell their goods. It is said to have been the custom to give these creditors as much as a year's time.

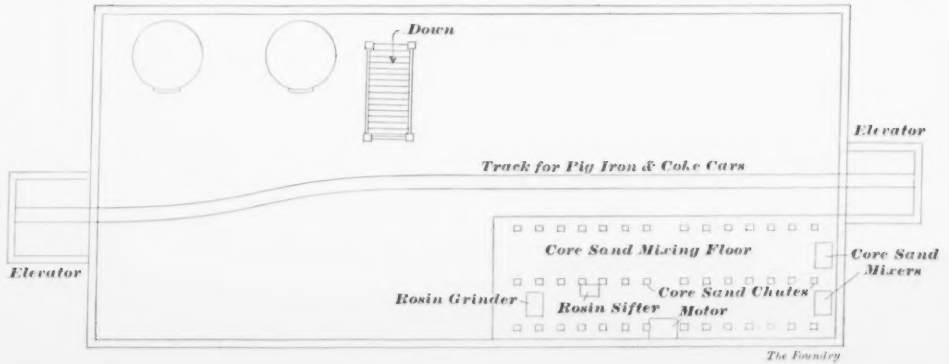
In 1880, a foundry 50x100 ft. produced all the gray iron used by this company. New buildings and additions have been erected from time to time since then, and in 1900, the building described in this article was finished. It is 100x400 ft., two stories high, the molding room being on the second floor. To avoid vibration and consequent loss of molds the construction is very heavy and substantial; in fact, if rails were provided, a loaded freight train could be run over this second floor without affecting it.



THE FOUNDRY OF THE MILWAUKEE HARVESTER CO.

PLAN OF SECOND FLOOR.

THE LOWER ILLUSTRATION IS THE PLAN OF THE THIRD FLOOR OF THE FOUNDRY ANNEX.

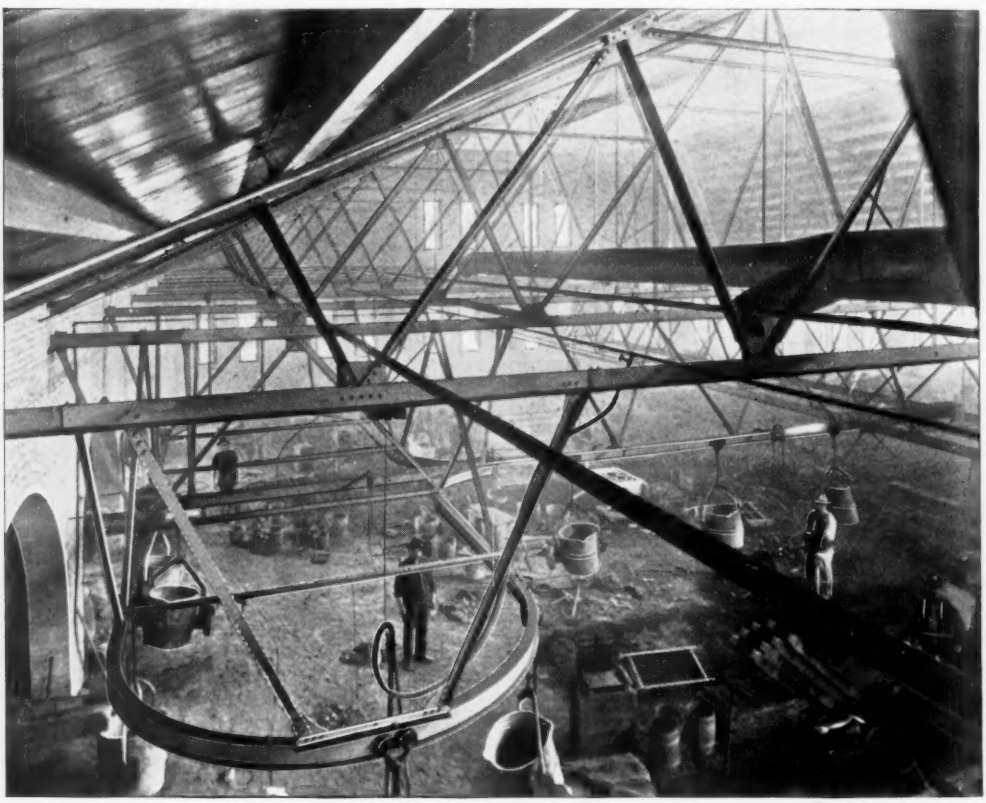


A steel truss roof covers the building, leaving a clear space for molding of 40,000 square feet, unobstructed by a single post or other support. An annex, 50x100 feet, containing the cupolas, core room, etc., adjoins the main building on the west, and is so located that it will be at the middle of the foundry after an addition of 200 ft., already contemplated, has been made at the north end.

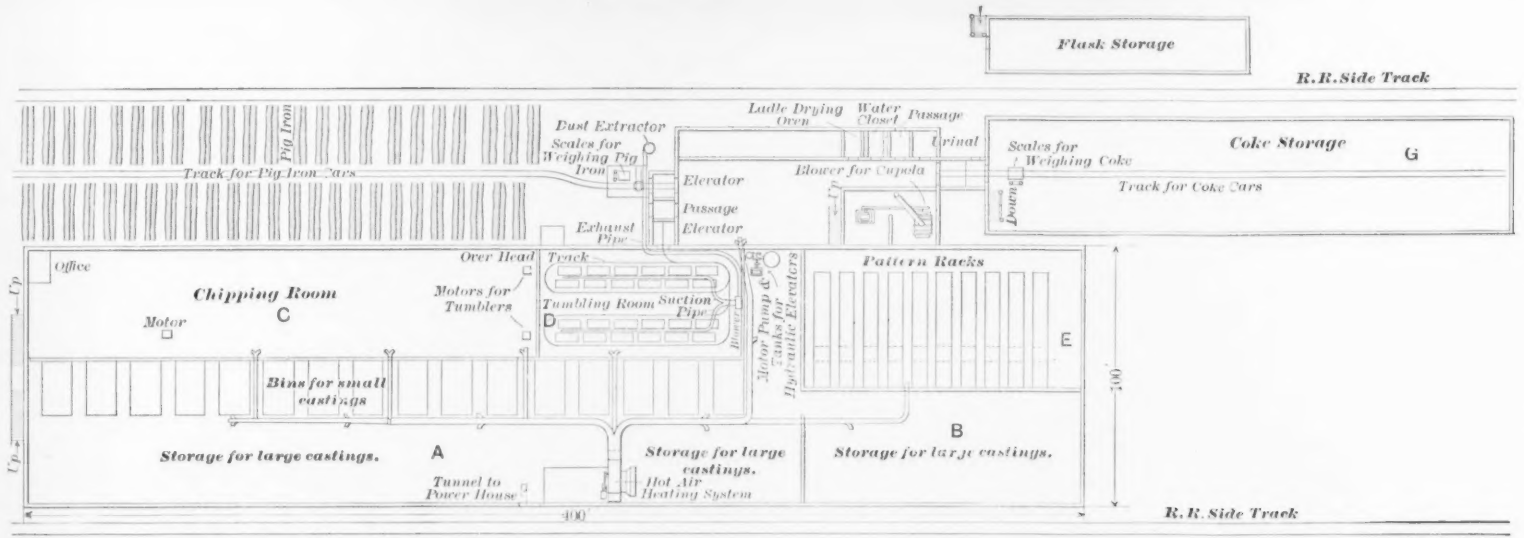
An overhead trolley-track system, composed of three parallel tracks, runs the full length of the molding floor, down the center, as shown in the plan. A large loop, with a center straight-cut in front of the cupolas, is connected with the main tracks by switches and turn-tables in such a manner that the full output of the cupolas (36 tons an hour) can be delivered to the floors without interference or delay. A branch track connects the main system with an elevator, equipped with an overhead rail; all castings are taken in this way on trolley-carriers to the tumbling mills below. An ingenious safety device at the elevator stops the trolley when the elevator is not in proper position to receive it. All switches and turn-tables are likewise arranged to prevent the possibility of the trolleys leaving the track. Switch-throwing devices are located eight or ten feet from the switch itself, so that the ladle-pusher can set his switches before he reaches them by simply pulling a chain.

The larger castings are made in the south end of the building, each floor being furnished with a crane, running on the lower chords of the roof trusses. An air hoist, suspended from each crane, is used for handling the molding machines and flasks, and for manipulating the ladles in pouring. The molders work continuously, a separate gang of men cutting sand and pouring. Laborers bring sand and supplies to the floors and remove the castings. Water pipes run along the sides of the room with a faucet for each molder.

A push button at each floor connects with



THE FOUNDRY OF THE MILWAUKEE HARVESTER CO. GENERAL VIEW OF ROOF CONSTRUCTION AND TROLLEY TRACKS.

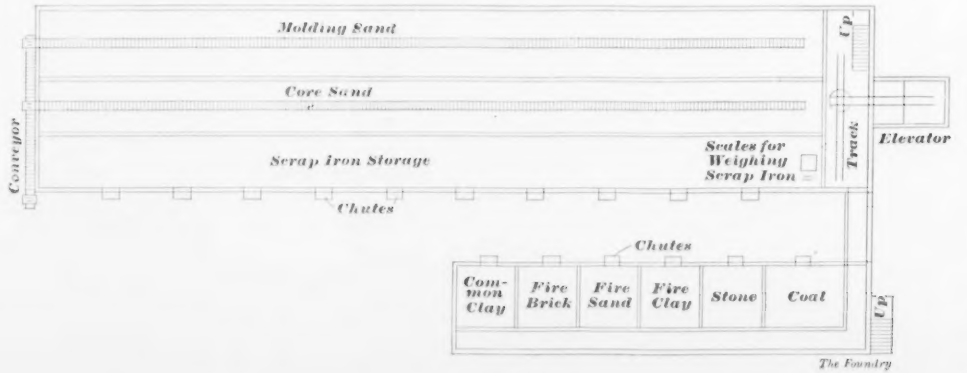


THE FOUNDRY OF THE MILWAUKEE HARVESTER CO.

PLAN OF GROUND FLOOR.

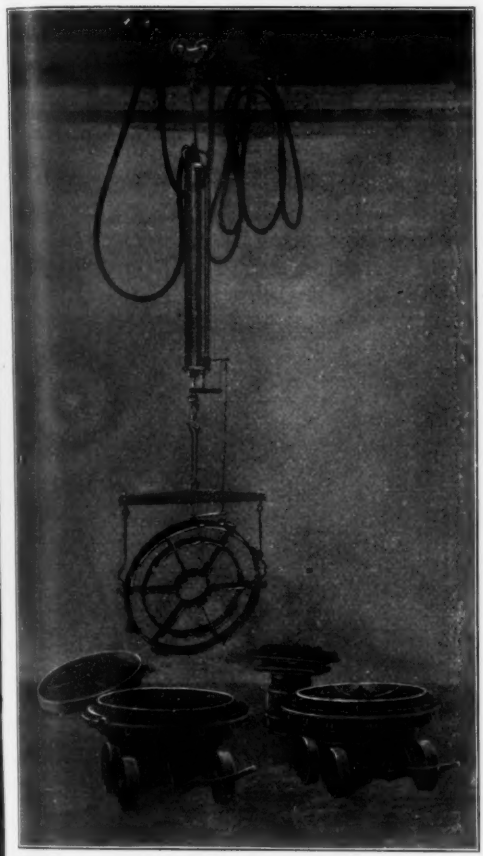
THE SMALLER ILLUSTRATION IS A PLAN OF BASEMENT.

SEE FIG. G, PLAN OF GROUND FLOOR.



INTERIOR VIEW OF FOUNDRY. THE MILWAUKEE HARVESTER CO.

ENGINE ROOM OF THE MILWAUKEE HARVESTER CO.



AIR HOIST ON ONE OF THE MOLDING FLOORS.

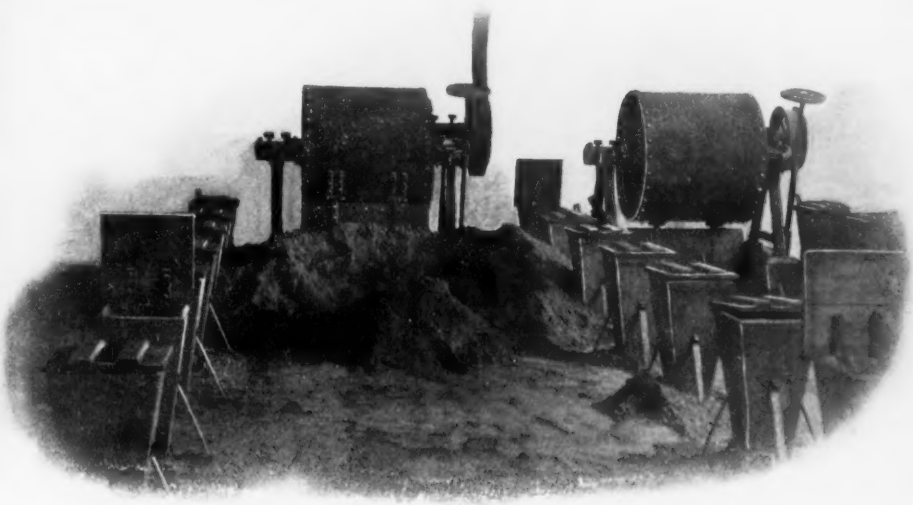
an electric annunciator in the core room, enabling the molder to signal for the particular cores needed in his work.

We have not space to describe the many ingenious labor-saving devices installed here, but will speak of one which particularly deserves notice. This is designed for drying the lining of large ladles and cupola spouts. A steel cylinder with perforated bottom, carrying a small charge of lighted coke, is inserted into a ladle, a sheet steel cover being placed over the mouth of the ladle to retain the heat. A blast of air through a connecting pipe produces an intense, steady heat, drying the ladle in about one-fourth of the time required in the usual firing, and without ashes, dirt or smoke.

The cores are made on the second floor of the foundry annex. Over each bench is a sand spout, through which the proper mixture is delivered to the workmen from the mixing room above. An automatic device delivers the sand as wanted and signals to the mixer when the spout is empty by ringing a bell and lifting the numbered cover of the spout.

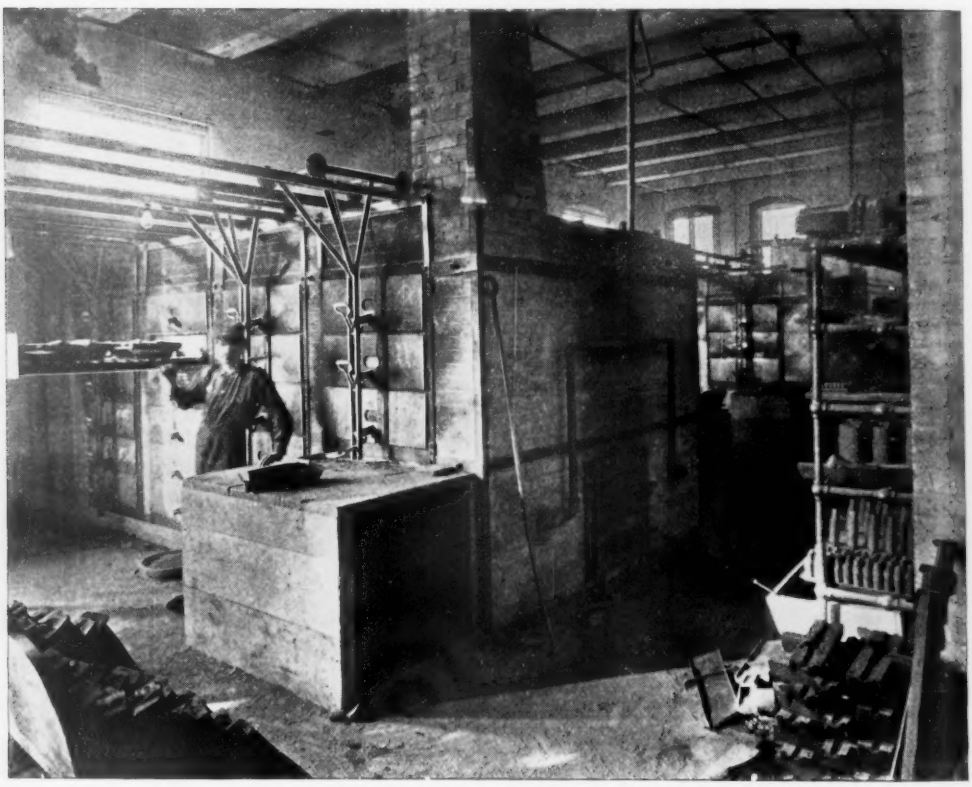
In the mixing room are machines for pulverizing and sifting rosin and for mixing core sand. The rosin pulverizers are similar to a tumbling barrel, with the addition of two pieces of loose shafting inside, which, rolling over each other in a direction opposite to the motion of the barrel, soon reduce the rosin to an impalpable powder.

The core ovens, although similar in some re-



SAND MIXING MACHINES, IN ROOM ABOVE CORE DEPARTMENT AND HOPPERS THROUGH WHICH CORE SAND IS DELIVERED TO CORE ROOM.

spects to the Taggart oven, described in the January *Foundry*, were built according to the original designs of Superintendent Crandall. The cores are placed on steel skeleton shelves fitted with supporting wheels at their inner ends. A series of hand-hooks (one for each shelf) is supported between bars suspended from the overhead trolleys. When a shelf is to be drawn out, the hand-hook is engaged with it, and turned down on its cam-mounting. This lifts the outer end of the shelf slightly so that it is supported by the trolley and the inner wheels, and moves in or out with slight effort. Coke is burned and combustion is aided by an air blast and jets of steam. The ashes drop from the grates through a pipe to a receptacle on the floor below.



A SECTION OF THE COKE ROOM AND COKE OVENS. MILWAUKEE HARVESTER COMPANY'S FOUNDRY.

The charging floor (third floor of foundry annex) is crossed by a narrow gauge track, which terminates at the elevators at each end of the room. All material for charging is brought to this floor by the elevators on especially designed cars or trucks. Each truck for pig iron, for example, is built to hold enough iron for one charge; it has flat-faced wheels to run anywhere on the floor. The large transfer trucks, with flanged wheels, are made with a low platform, and run on a depressed track, so that the pig iron trucks can be pushed upon them from the floor. The cars for coke and scrap iron have automatic dumping boxes, each large enough for one charge.

The floor of the entire lower story is of concrete and cement, to sustain the weight of the castings stored here, which, in some places are piled to the ceiling.

Room A is for the storage of the larger castings, such as binder and mower frames, wheels, etc. Large bins are arranged along the west side of this room for the storage of small castings. These bins are labeled and indexed to avoid delay in finding the required pieces.

Room B is similarly fitted up for castings used on a different style of machines.

Room C is equipped with emery wheels, vise

benches, etc., for chipping and grinding the castings. The dust is removed by an exhaust system.

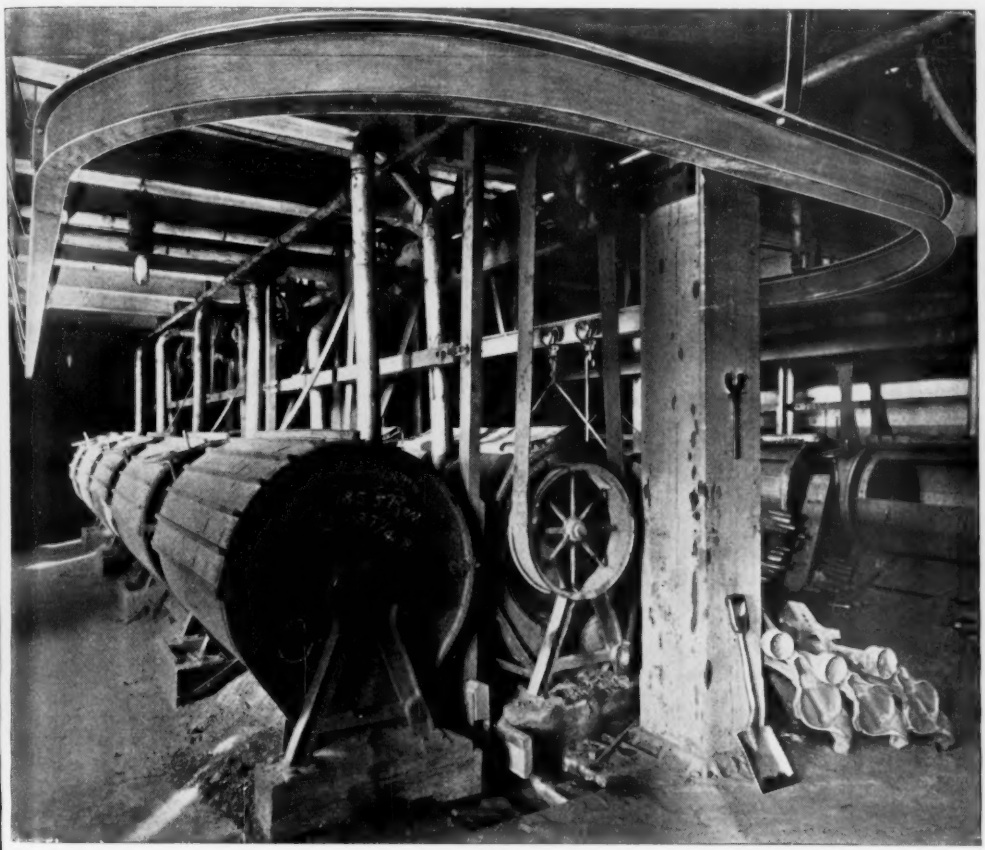
Twenty-four tumbling barrels are located in room D, in two groups of two rows each.

An overhead trolley system brings the castings from the molding room on the second floor down the elevators, and thence to the tumbling barrels, where the rough castings are unloaded direct from the suspended car into the rattlers.

dust filler outside of the building; consequently this room is neat and clean.

The pattern storage room (E) is a fire proof apartment, fitted with racks and shelves, systematically arranged labeled and indexed, so that it is an easy matter to find any desired pattern.

The first floor of the foundry annex shows the location of the motors, blower, etc., and on the west side will be noticed a drying oven for hand ladles, closet rooms and a large



TROLLEY TRACKS AND TUMBLING BARRELS, WITH DUST EXHAUSTERS, IN FOUNDRY OF THE MILWAUKEE HARVESTER CO.

After tumbling, the clean castings are conveyed by means of the trolley (not shown in cut) to the chipping room, and when finally finished, they are transformed to the storage bins by the same method.

The tumbling barrel room is supplied with an elaborate system of dust extractors, whereby the dust and dirt are taken from the rattlers and carried through an exhaust pipe to a

bath room fitted up with hot and cold shower baths.

The closet and bath rooms are finished with heavy glass walls, which resist the action of water better than marble or cement.

Directly north of the foundry annex is a one-story brick structure, G, with basement 45x200 feet. The basement is used for the storage of scrap iron and sand. It is equipped

with narrow gauge track running from the bins to the elevator. Sand is taken directly from cars on the railway track west of this building, and by a system of chain conveyors is deposited in the bin for core sand or molding sand, as the case may be.

Scrap iron is unloaded directly into the basement through chutes, which reach up to the cars. Coke is stored on the first floor, which is level with floor of cars and is

al inches of cinders. After this covering was rolled level, a floor of 3 inch oak plank was laid.

The ends of the piles abutting on the narrow gauge track are plainly numbered. Samples from each car are analyzed when received, and the mixture made accordingly, the workmen putting on the trucks the amount of each pile specified on the mixing card.

The great saving in time and labor in this

CHARGING SCAFFOLD. MILWAUKEE HARVESTER CO.'S FOUNDRY.

traversed by a narrow gauge track leading to the elevator. A tunnel under the railway track connects the basement of the storage building just mentioned with the basement of a smaller building used for storing fire brick and clay, limestone, coal, etc.

The pig iron yard, south of the annex, has a capacity of over one hundred piles, each pile being one carload. These piles are in two rows; the railway switch running along the western edge of the yard, and the narrow gauge track between the rows. The ground where the iron is piled was first covered with several inches of cinders. After this covering was rolled level, a floor of 3 inch oak plank was laid.

The ends of the piles abutting on the narrow gauge track are plainly numbered. Samples from each car are analyzed when received, and the mixture made accordingly, the workmen putting on the trucks the amount of each pile specified on the mixing card.

The great saving in time and labor in this foundry is due to the fact that nothing is handled unnecessarily. By former methods, the material and product were loaded and unloaded, piled and repiled, several times before reaching their destination.

In addition to the foundry, a five-story wood-working building has just been completed. In this building, as it is throughout the plant, all machinery is divided into groups, each group being driven from its own line shaft, belted to a motor, so that the various departments are independent of each other in the matter of power.

The buildings and grounds are abundantly lighted by both arc and incandescent lamps. The electricity for this purpose and for driving the machinery is supplied by three Westinghouse alternators. The engine room also contains the fire pumps, with a capacity of 2400 gallons a minute, connected with hydrants and automatic hose reels, which are scattered through the plant. The air compressor is also located here, to supply air for the pneumatic lifts and tools used in all departments.

The boilers (horizontal fire-tube type) are equipped with patent smokeless furnaces.

The present capacity of the factory is 80,000 machines a year; additions are now contemplated to increase this number, in response to a growing demand for the high-grade harvesting machinery produced.

Credit is due Mr. H. F. Crandall, superintendent, who planned the arrangement and equipment of the new buildings; Mr. A. J. Inglis, the company's architect, who worked out the details of construction; and Mr. G. H Schulte, vice president and general manager, who contributed the results of his long experience in the business, and directed the execution of the work.

IN FRONT OF THE CUPOLAS, SHOWING SYSTEM OF TROLLEY TRACKS, MILWAUKEE HAVESTER CO.'S FOUNDRY.

Sawdust and shavings from the wood department are brought by a system of fans and blow-piping to the furnaces, and fed to the fires automatically.

Concentration is the underlying principle of the arrangement of this plant, and the buildings are high and close together. High-speed hydraulic elevators convey material from floor to floor, and it is taken from one machine to another with scarcely an interruption until finished and delivered to the erecting rooms.

The Sixth Annual Convention of the American Foundrymen's Association at Buffalo.

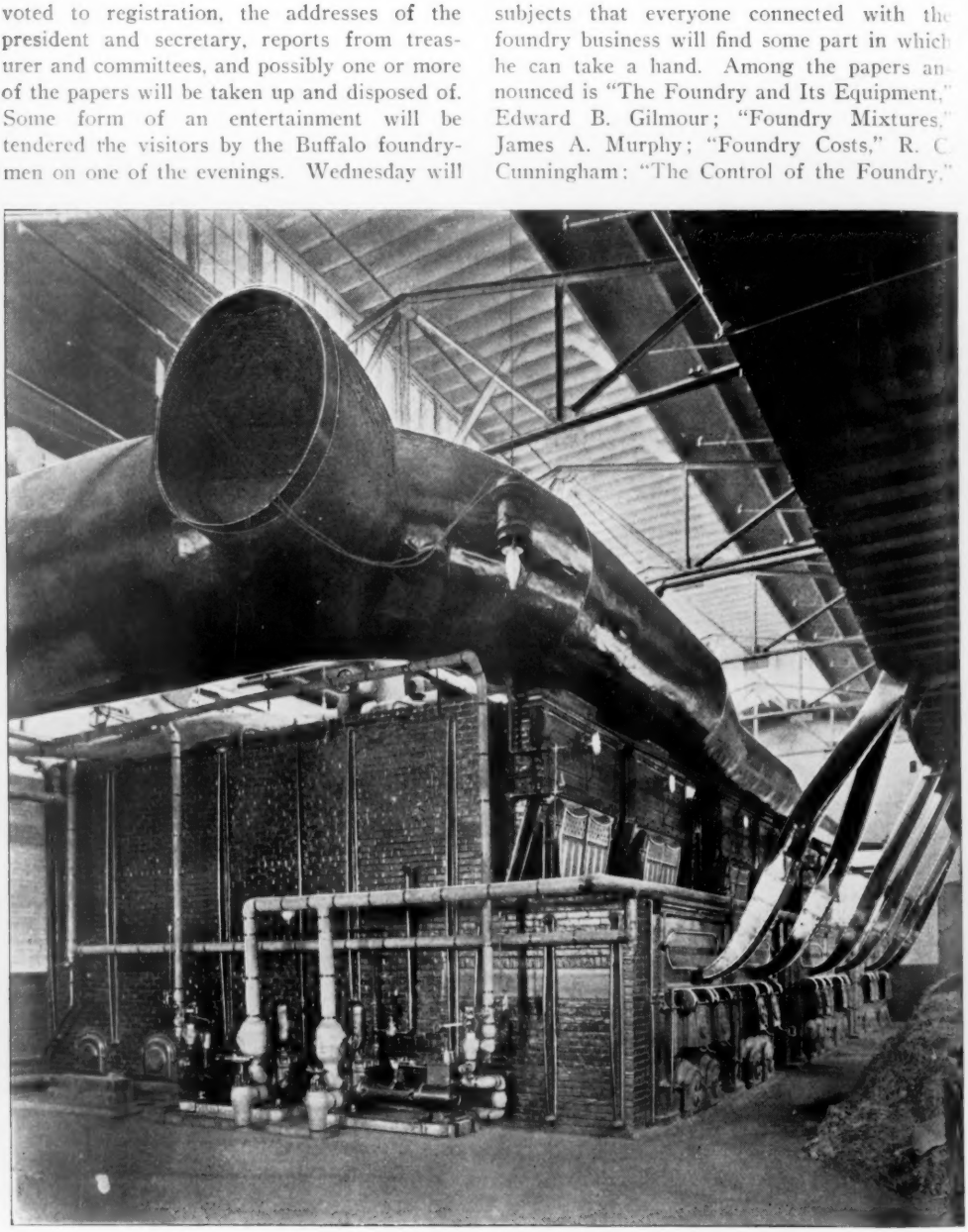
From present indications unusual interest is being taken in the meeting of American foundrymen to be held at Buffalo, June 4, 5, and 6. No hard and fast program has at this writing been decided upon, but the visitor can be assured of plenty of material to keep him busy.

Tuesday, the opening day, will likely be de-

voted to registration, the addresses of the president and secretary, reports from treasurer and committees, and possibly one or more of the papers will be taken up and disposed of. Some form of an entertainment will be tendered the visitors by the Buffalo foundrymen on one of the evenings. Wednesday will be given over to a trip to Niagara Falls. Upon returning the evening hours will be devoted to the reading of papers and discussions of same. On Thursday the balance of papers written for the meeting will be taken up and unfinished business transacted.

There will be plenty of material for discussion, the papers treating of such a variety of subjects that everyone connected with the foundry business will find some part in which he can take a hand. Among the papers announced is "The Foundry and Its Equipment," Edward B. Gilmour; "Foundry Mixtures," James A. Murphy; "Foundry Costs," R. C. Cunningham; "The Control of the Foundry," Percy Longmuir, who also contributes a second paper on "The Relation of the Laboratory to the Foundry;" "The Economic Status of Wages," E. H. Putnam; "The Influence of Titanium on Cast Iron," A. J. Rossi; "The Problem of the Molder," J. G. Sadlier; "Green Sand Cores," P. R. Ramp.

In addition to the above, papers or discus-



BOILER ROOM, MILWAUKEE HARVESTER CO.

sions may be had on any of the following subjects: "A New Departure in Founding," "Molding Steel Couplers," "Molding Machines," "Foundry Buildings," "Insuring Patterns," "Sand Blast," "Foundry Metallurgy," "Influence of Manganese on Cast Iron," "Steel Castings," "Grading Pig Iron by Chemical Analysis." Reports will also be received from the Committees on Constitution, Standardizing Bureau, and the Testing of Cast Iron.

selling transportation, otherwise a reduced fare cannot be obtained for the return trip.

Kranks' Korner.

The foundrymen as a class are improving, at least morally. It is no longer considered a sign of incompetence for one to say that he can only melt six or eight pounds of iron with a pound of coke. Those who shouted so much

A PORTION OF THE CORE ROOM. MILWAUKEE HARVESTER CO.'S FOUNDRY.

Hotel Niagara has been selected as headquarters and as a large number of visitors are expected, those who desire to attend are asked to reserve headquarters at once. President McKinley will visit Buffalo June 6, which will add to the difficulty of securing first-class hotel accommodations unless these are reserved in advance.

Dr. Moldenke, secretary of the Association, announces that the usual fare of one first-class fare, plus one-third, for the round trip, has been promised by the railroads. Delegates' certificates should be obtained of the agent

about their low consumption of fuel in the past have been proven prevaricators of the first water.

* * * * *

An item touching upon this subject has been traveling the rounds of the technical press in this country and so far has met with no resistance. If I am not mistaken I can read between the lines of the same the name of a certain party in Great Britain whose knowledge of the foundry business in a practical way is by no means as complete as it should be.

The item to which I refer reads in part as follows:

"The coke necessary for melting a ton of iron is a very variable quantity, for while theoretically somewhere about forty pounds should be enough, after making allowance for inert substances combined with fuel, in practice very much more is required, and in some cases the writer has found that nearly 400 pounds per ton has actually been used. During the last four or five years the writer has melted about 300 tons of high-carbon steel, and very nearly 1,000 tons of iron, and with very careful working has found that the steel took 650 pounds of coke per ton, and iron—about equal parts of medium scrap and hematite pig—107 pounds of coke per ton, although at times an average of ninety pounds was maintained. The coke varied considerably, and the cupola was not one of the best, but still the fuel could not afford cause for serious complaint if all circumstances are taken into consideration."

* * * * *

I am geting tired of debating the consumption of fuel in cupola practice with a lot of prevaricators who either lie willfully or through ignorance. However, if the writer of the above will demonstrate that he can melt iron fit for casting at a ratio varying from 1 to 18.7 to 1 to 22.2, I know of quite a few foundrymen who would be glad to give him their check for five thousand dollars each.

* * * * *

If he was able to melt iron at these ratios in a cupola that was not the best and with coke that varied in quality, what would he be able to do with everything right? Let him either shut up or show us the trick; there is money in it for him and no reason whatever why the secret should die with him.

* * * * *

There is many a foundry foreman who has been declared a failure in one shop and a decided success in others with whom he later became connected. In a great many instances employers go too much on recommendations and letters of approval, when all of these are unreliable. Personal feeling enters so much into matters of this kind that about the only test there is of a foreman's ability is to put him in the shop and let him show what he can do.

* * * * *

As a rule the foreman's failure is due to the fact that he is not foreman. His authority exists in name only. He can suggest, but not command, and yet he is held responsible for the final result. He is handicapped by a job lot of officeholders who know nothing about a foundry and yet desire to direct its operations.

* * * * *

I have been somewhat criticized for saying that those who are finding fault with the molder and the amount of work he turns out daily should go into the shop and duplicate his performance. To one who has worked at the trade there is certainly something humorous about the editorials which have appeared in several trade journals during the last year or two in regard to shop committees and limitation of output.

* * * * *

It is said that a man can keep on relating a falsehood until he believes he is telling the truth, and I feel as if the repeating of these editorials referring to imagined shop abuses has actually made a lot of foundrymen believe that their molders are taking a day to do the work they should accomplish in an hour or two. Certain it is that several foundry proprietors never discovered their molders were guilty of loafing until the subject was aired through the aforesaid lights of trade journalism.

* * * * *

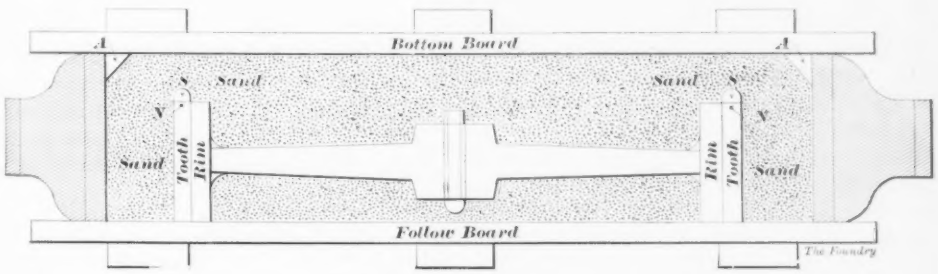
Most of our foundries are simply departments of manufacturing concerns whose chief interests lay wholly outside of the foundry and whenever they set foot inside of this they may be regarded more as visitors than anything else. That their casual appearance in the foundry should lead to wrong conceptions concerning its operations is not much to be wondered at.

* * * * *

If a vote could be taken among those who operate foundries and who have started at the bottom I sincerely believe that all would say that the molder is turning out a fair day's work. I have noticed that none of those who are doing all of this talking about the molder limiting his day's work have as yet made application for either themselves, relatives or friends to enter the foundry and enjoy some of the easy times the molder finds there. Nor will they. Meanwhile we are probably devoting too much attention to those who are talking about the molder and his work without knowing what they are talking about.

A Cheek Without Bars or Gaggers.

The subject of this sketch is a gear wheel, 4 feet in diameter, 10-inch face, shroud top and bottom, and one of those jobs commonly known as a "break down," wanted today sure, and generally finding its way into the foundry at an unseasonable hour. No matter how much time the patternmaker has had to construct it, the molder's time is limited. The job in question came in at 9 a. m., and under the circumstances, as a matter of course, the carpenter didn't have a flask ready for it, so our first impulse was to construct a new cheek the required depth and bar it up in the usual way, but the length of time required to do all of this would knock out all possible chances of casting it that day, unless the blast held back, and that was a thing unknown in this shop. So we expiained an idea (not a new one by any means) to the foreman, one that had been practiced in the shop before, but on work of another character and very much smaller.



A CHEEK WITHOUT BARS OR GAGGERS.

He demurred at first, saying he thought the flask required would be too large to take any such risk, but he finally allowed us to "try it anyhow," and after hunting through the flask pile out in the snow we procured one 5 feet square. The shrouds were all taken off the pattern and the latter laid on a board, and while tucking the teeth up with facing, the helper tightened the long rods on drag with a wrench, and after clay-washing it, placed it on board, pin plates down, and while ramming up as high as face of pattern the carpenter was nailing three-cornered strips all around on inside of what was now top side of drag, A A. This done, we rammed up to edge of strips, and after inserting a long spike nail in each tooth, as shown in N N, parting was made as per dotted lines from outside edge of teeth up to edge of strips A A. There being no gaggers to set and no bars to contend with, quick time was made thus far. Wet parting sand was applied, and inside of wheel rammed up as high as rim, shroud S S placed on, facing put on same and tucked snugly all around, after which the drag was rammed full, struck off, bottom board put on that projected over sides and ends at least an inch, clamped, rolled over and parting made, cope rammed up, lifted off and set aside on high trestles, so that it could be finished overhead by one molder while another was working on the cheek or drag. The cheek was now staked from the bottom board with large spike nails, pattern drawn out, teeth smoothed back on top and cheek lifted off, finished and lowered very close to the floor, a scattered fire started inside, the whole being covered with sheet iron and left to skin dry. Shroud was drawn out of drag part left on bottom board, finished in the usual way, cheek set on, examined carefully, hub core set, cope closed on, clamped and cast.

The drag was about four inches deeper than face of wheel, which of course in this case was quite necessary to permit of making the joint of shape and incline described. There was much speculation as to whether that cheek could be handled after having been rammed up in that way without bars or gaggers, it was so large. Smaller cheeks had been handled that way before with safety, but this was the largest one ever attempted on that plan, but it never cracked or showed any signs of giving away, and the reason is plain. The mold was a circle, and the joint from edge of teeth down to three-cornered strips was slanting, and practically the entire cheek was an arch and couldn't give way with ordinary handling, with the strips on bottom holding sand from slipping; the teeth were hanging over the circle, but were secured, as stated above, by inserting a spike nail in a slanting position.

For gear patterns ranging in sizes from 4 feet in diameter and less, with very deep face

that it is impossible to get a good draw on, a cheek of this kind can be used to great advantage; even though the wheel be plain, the slanting parting can be made from outside edge of rim to A A instead of from outside edge of teeth to A A; then if draw is bad enough to warrant lifting cheek off, the sand teeth are resting on terra firma instead of hanging over joint, as in the method described of wheel with shrouds, and need not be nailed as shown at N N. If the draw is bad, with cheek off the process of mending teeth is easy, and loose sand is not falling into the mold, consequently there is none to clear out with a lifter, with a possibility of knocking more teeth down. After bottom part is finished, a minute's careful work with the bellows cleans it all out. For some wheels and pinions that must be raised this is a most excellent plan; the pattern can be drawn up just a little higher than the thickness required, secured there, cheek and pattern lifted off together, thickness blocks or strips set in place, cheek returned and pattern tapped to rest on blocks; this, instead of drawing pattern out altogether, as is sometimes done, and in most instances giving much trouble and annoyance in returning it, by shaving and breaking teeth. Another advantage is that it can be easily shaken out after casting and can be used as a drag next time on another job without having a lot of bars to knock out, which would have taken much time, labor and material to put in. For almost any kind of pattern that is circular in design, and must necessarily be cheeked off, this plan will be found to be an excellent one. Try it.

RICHARD BARNETT.

Repeat Castings.

The accompanying sketches show the method employed in molding a casting in loam.

Fig. 1 is the casting. The principal dimensions are: Diameter 9 feet, depth 4 feet, thickness of metal 1 inch, with external flanges and bolt holes cast in both top and bottom flanges.

Forty castings were required to complete this order. Not enough, we considered, to warrant the making of a cast iron casing and too many for it to be made in the ordinary way, viz.: by bricking up a complete cope for each one and pulling it down again to liberate the casting. As the means employed proved to be economical and fairly simple to work, a description of the making of this casting may not be out of place.

In the first place, a cast iron flange and seat is struck up in loam and cast open. This is bedded in the floor level and the center and spindle set true with it. The cope strickle is set as in figure 2 and is not removed until the whole of the castings are made. In this way, the one setting of the sweep for the forty copes gives the likelihood of each piece being the same size and also saves considerable time which would be lost in the constant resetting of the sweep.

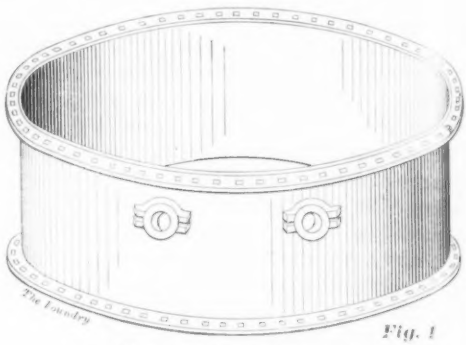
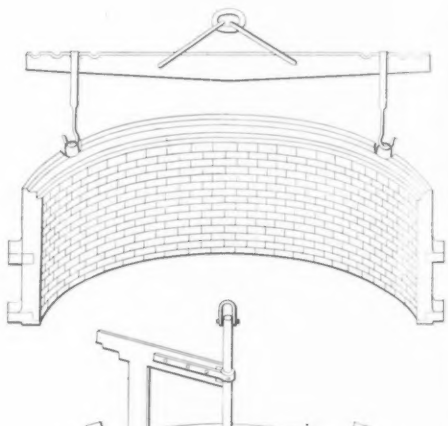


Fig. 1

The Casting to be made

The cope ring is first bedded on seat as shown in the second figure, the top face of the ring coming about level with the back of the flange. Two rings are cast with prods of sufficient length to form the depth of the



Cast Iron Flange

Fig. 2

cope. These are split in halves, provision is made to clamp them together by means of suitable snugs cast on the splitting points of each ring, bolts are also cast in the bottom ring and holes in the top ring to bind them both together.

The bottom ring is bedded on the cope ring

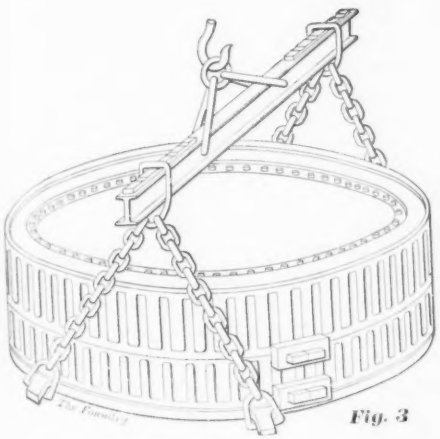


Fig. 3

back of the flange, and the building of the mold proceeded with, one complete half of the cope being first built. A joint is now made down the side of the cope extending from the top of the cope to the back of the bottom

Fig. 4

flange. The remaining half is next completed and the ring clamps are wedged onto the snugs to bind the building together. The cope is fired where it stands and then raised on stands to permit of the finishing of the bottom flange.

The core is built on a bottom ring, single brick wall, the center being fastened to the ring and the sweep set once for all as in the cope. The top or covering ring is swept, having its center fastened to it as in the previous portions of the mold. The cores are set by template on the face of the bottom flange and back of the top flange. The cope is lifted by the cope ring and lowered over the core as in Figs. 3 and 4. A sand runner is first made up on the covering ring, previous to setting it on the cope. Figure 5 shows mold complete ready for pouring.

After casting, the gates are eased in the covering ring, which is now lifted off, set on

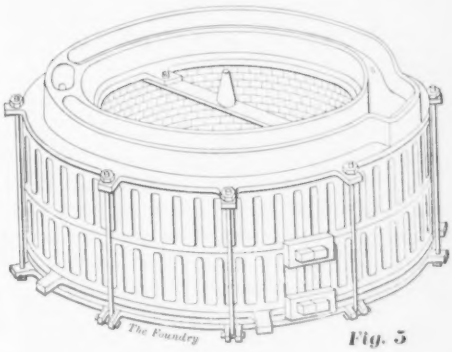


Fig. 5

its back and swept up, the burnt loam being first scraped away.

When the casting is sufficiently cool, usually the next morning, the clamps holding the building rings together are knocked off and a bar inserted between the snugs, and the cope is pried open as in Figure 6. The crane is hooked to suitable staples and the half cope

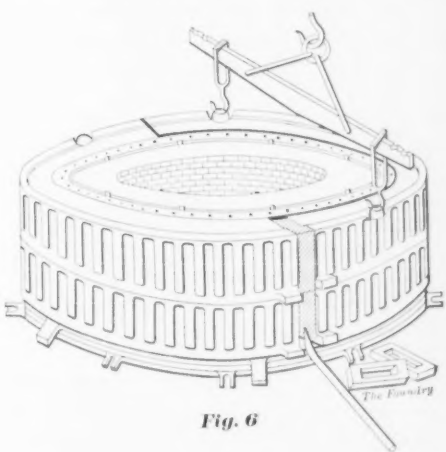


Fig. 6

is easily swung clear of the casting. The loam is cleaned off and the half circular building is set down on its seat; its original position having been marked, no difficulty is experienced in setting. The remaining half of the cope is taken off the casting and set opposite the first. The clamps are now replaced

and the mold swept up and finished as before.

As we required one casting per day, two copes, two rings and two core plates were required. After casting the first piece no difficulty was experienced in continuing to do the same every day until the order was finished.

All rings and tackle used are made in open sand, and the original cope building, when the job was through, was good for another similar order.

GEORGE BUCHANAN.

Name Plates.

The placing of the makers' name upon machinery and similar appliances is an admirable and firmly rooted custom. The practice serves two purposes. First, it acts as a lasting advertisement for the manufacturer; second, it enables the untrained eye to detect at once the origin of the machine.

There are, ordinarily, two methods of putting a name upon a machine. The first and cheapest, but one quite satisfactory in many instances, is to cast the name, preferably in raised letters, upon the surface of the machine. The tops of the letters are afterwards ground off or painted white, and if the body of the machine has been painted a dark color, they become quite conspicuous. This method is perhaps more applicable to large than small machines, as the letters then may be of large size. Some disadvantages occur in this practice, however. For instance, many machines will not allow the name to be cast in a sufficiently conspicuous place; again, unless the letters are constantly polished or painted they soon lose their original appearance and become almost obliterated. Some letters of the name, too, may have been imperfectly cast and thus an unsightly result is produced, although the remainder of the casting is of such a quality that it cannot be rejected. On the whole, therefore, this method leaves much to be desired.

The second method is to cast the name upon a plate and fasten it, either by screws or rivets, to the surface of the machine. It is a practice, without doubt, the most satisfactory and the one used by the majority of machine builders. The plate may be put in places where letters could not be conveniently cast; the trouble of imperfect castings does not affect it, and it may be used upon machines or appliances which do not contain castings. Then, too, a neatly made plate of rich bronze or analogous metals, enhances the appearance of a machine, a quality which our American machine builders invariably seek.

These plates are called name or machinery plates and are rarely made of anything except bronze or aluminum. Iron is, however, occasionally used, but unwisely, for the actual cost of a good bronze name plate is so small that a judicious manufacturer hardly cares to give his machine the unfinished appearance produced by an unsightly iron name plate. Brass is likewise used, but the color is not so pleasing as bronze, and there is little difference in the cost. Then, for technical reasons, bronze or aluminum are better suited for the work.

The ordinary name plate which consists of bronze, brass or aluminum may be made in two ways. First, by stamping from sheet metal in a drop press, a costly operation if only few are to be made and a cheap method if a large number are desired, as the cost of the die is the chief item of expense and must be apportioned among each plate made. The plate may be made very thin by this method, but the results obtained are not as beautiful as those obtained from a cast plate. The drop press method is one used for the production of a cheap grade of plates.

The second or usual method is to cast the plates in sand from a pattern which has been previously made as perfect and clean cut as possible. The pattern is the chief secret of success and unless extraordinary care is used in making it smooth and with plenty of draught, perfect results must not be expected. The pattern should be of metal, preferably brass or bronze; wood will not answer. The surface should be chased so as to leave the surface as free from imperfections as possible. If the name plates are small they may be gated, but the gate should not be too large, as it then becomes much more difficult to obtain a good "draw," and face surfaces are apt to crack in drying or handling. A flask 10 by 15 inches is not unsuited for this class of work. Of course, the plates are of various sizes, so that they range from one the size of a silver dollar up to the largest bridge or monument tablet. The majority, however, are small. If the plates are large so that only one may be put into a flask a "set gate" should be used, for if the sand is cut out for the gate and runner, with a gate cutter, the surface is invariably left rough, so that when the metal is poured into it more or less sand is washed into the casting, which produces pits on the surface.

The sand should be fine. A Windsor Locks

sand or its equal will answer well. When the mold has been made it should be "skin dried" before a stove and then smoked with a gasoline torch or anything of a similar nature which is capable of producing an even coating of lamp-black upon the surface of the mold. Gasoline is preferable, but its use requires much care. It is necessary to dry the mold, as green sand cuts and washes under the influence of the stream of molten metal. Then, again, the metal will run into much thinner castings in dry than in green sand. The smoking of the mold serves a two-fold purpose. It gives a smoother surface to the casting and also prevents the sand from becoming burned on to the metal. The skin of the casting, also, is much brighter and uniform in color when the mold has been smoked.

The pouring, except in work too large, is best done on end, as such a practice enables a much thinner casting to be poured and the temperature of the metal is kept down at the lowest possible limit.

The metal or alloy from which the plates are to be made is really of less importance than the molding, although a sluggish metal should, on no account, be used. Aluminum has recently come into prominence for this work and a nicely made aluminum plate when relieved by a black background gives a machine a pleasing appearance. Alloyed aluminum should invariably be used, as the pure metal is too soft to hold its shape. Aluminum containing 6 per cent of copper works well. The melted metal should be poured at as low a temperature as possible in order to guard against porosity and consequent roughness of the surface. Overheating the metal, for the same reason, must be avoided.

Yellow brass is not often used, both on account of color and the large amount of zinc which it contains; the latter produces so much smoke that the surface of the casting is apt to suffer. Bronze, or, as it is not infrequently called, red brass, is, by far, the material most generally used for the purpose. It is hard, takes the fine impressions in the sand, does not rust, and has a pleasing color. The composition should come within certain limits in order that the color may not suffer, but beyond this requirement exactness is not absolutely essential. Personally, I prefer an alloy containing considerable tin, as the casting is then hard, of better color, and flows more readily on account of the melting point having been lowered. A formula which has given me excellent results is as follows:

	Per Cent.
Copper	90.00
Tin	8.00
Zinc	2.00
	100.00

The copper should be of good quality if satisfactory results are desired. Lead is not necessary and a good brand of electrolytic leaves nothing to be desired. Too much tin in the alloy should be avoided, as the metal has, under these conditions, a much greater tendency to burn the sand on the surface. The zinc in the alloy is necessary to insure sound work and a free running metal. Lead should not be used in an alloy of this description. It is apt to produce spots on the surface, and bronze containing lead tarnishes much more readily. Inasmuch as the castings do not require to be worked, the use of lead in the alloy is superfluous. The above formula contains considerable tin and is consequently expensive; many foundrymen, therefore, prefer an alloy containing less of this element. For them, the following may be substituted:

	Per Cent.
Copper	92.00
Tin	3.00
Zinc	5.00
	100.00

The zinc should be kept down in these alloys for an excess not only injures the color, but the alloy does not cast as well.

Scrap composition or similar alloys may be used, but like all scrap do not give as good results as new metals. Again, these scrap alloys invariably contain lead, which, as noted above, is to be avoided.

After the plates have been cast, the gates cut off and sprue ground down, they should be given a scratch brush finish and the surface of the letters lapped down. Pickling should be avoided, as it tends to discoloration. Dipping may be resorted to in certain cases, but is unnecessary if the casting operation has been well done. Beautiful effects may be produced by various coloring and oxidizing processes. After the plates have been finished they should be given a good coat of lacquer in order to prevent tarnishing.

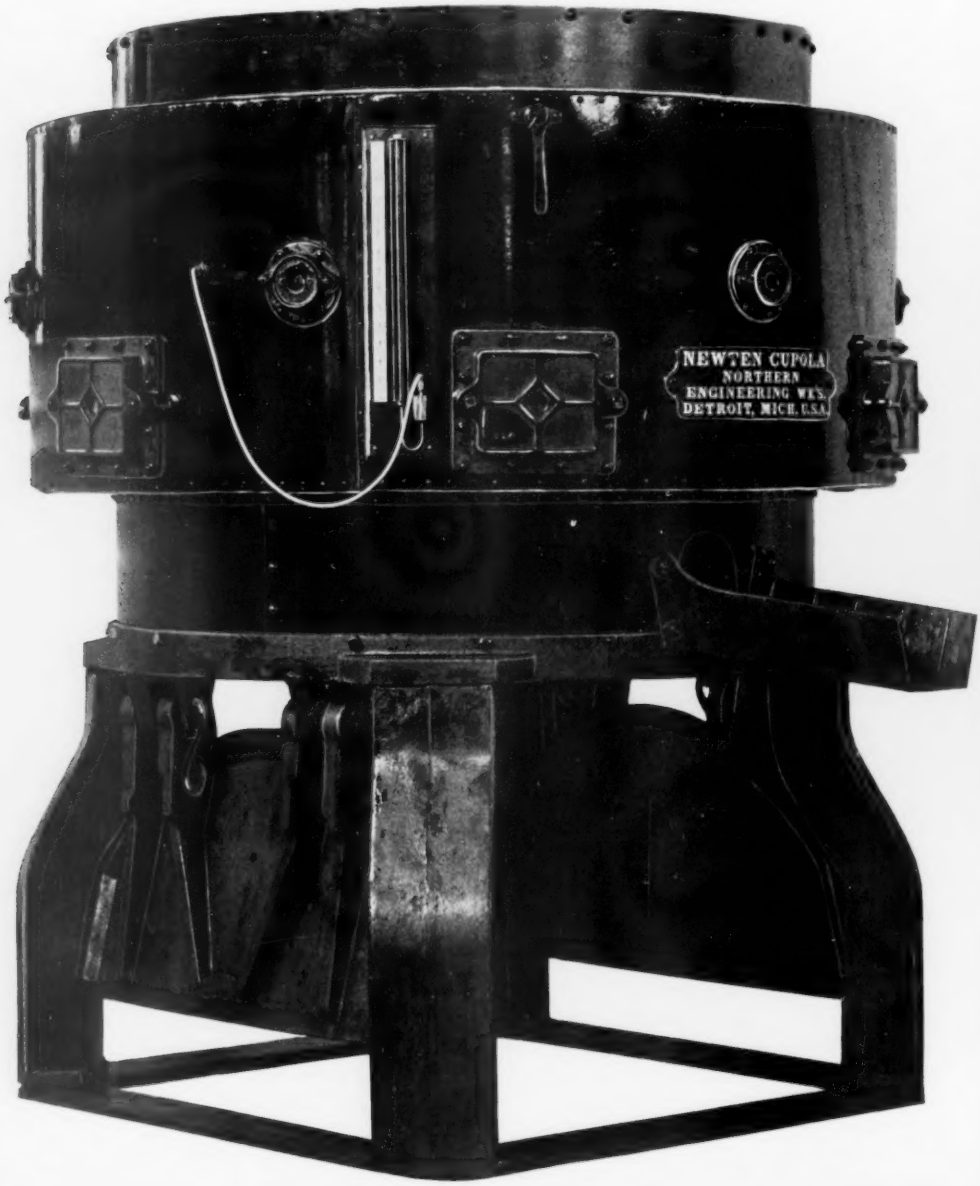
In conclusion, it may not be amiss to add that the most beautiful plates which the writer has ever seen were made by the Smith pressure casting process. By this method the metal is forced into a plaster of paris mold, the smooth surface of which is peculiarly suited for this class of work.—[Edmund S. Sperry in Aluminum World.

The Newten Cupola.

We show herewith an illustration of the Newten cupola which is being placed on the market. In designing this cupola consideration has been given to the importance of proper tuyere area together with the most desirable tuyere shape. The object has been to secure as far as possible a distribution of blast over the entire area of the furnace. The tuyeres are adjustable. A safety tuyere is provided with soft metal trap.

The steel air chamber is of the belted type made entirely of steel, caulked top and bottom, and will keep tight under severe expansion and contraction. Peep holes are provided in the air chamber, all tightly fitted, and there are cleaning doors convenient to each tuyere.

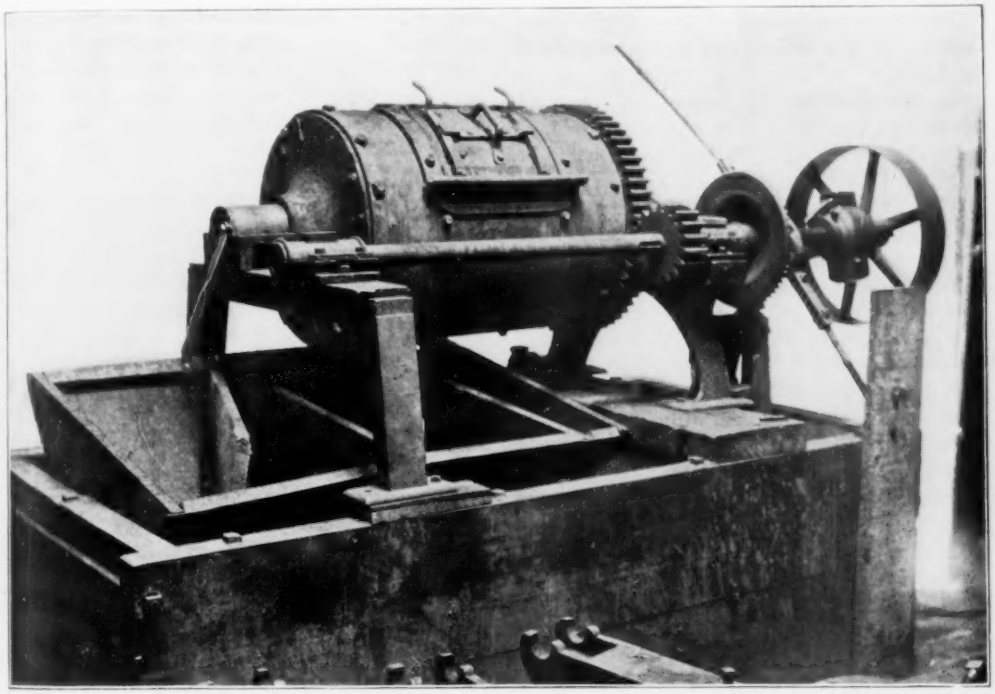
The stack is of extra heavy steel, machine



THE NEWTEN CUPOLA.

riveted in sections, with "down-opening" joints and with angle shelves for supporting the brick lining. The charging door is extra large, with a specially designed frame. The door is of either the wire screen or the plate type. Bottom doors are of the drop type, strongly ribbed, and having four hinge ribs on each door. Angle shelves, blast meter, improved tap and slag spouts, extra heavy bottom plate and foundation plates are all in accordance with the best modern practice.

This cupola is made in ten sizes, from 36 inches to 108 inches in diameter of shell, and is supplied either without stack as shown in cut, or with a stack of any desired height, to suit conditions. The usual extra attachments consisting of spark arresters, roof hoods, and operators' platforms are furnished on special orders. The Northern Engineering Works of Detroit, Mich., are the manufacturers.



THE SLY WATER-MILL.

The Sly Water-Mill for Brass Founders.

The cost of the more expensive metals, such as brass and copper, renders the recovery of wasted particles of the utmost importance from a financial point of view. We illustrate herewith a water-mill, designed and patented by W. W. Sly of Cleveland, Ohio, for the recovery of waste metals from slag and refuse.

The machine is mounted on a tank as shown in the illustration, a pump being attached to the mill which furnishes a constant supply of water. In the interior of the mill there is a crusher which breaks up the slag, cinders and the like, the metal settling to the bottom, and the worthless material being washed out through the discharge end of the mill.

It has been found in practice that in the recovery of the more expensive metals a large quantity of same is washed away in the form of a very fine dust. In order that this, too, may be recovered Mr. Sly has added to his mill a device made somewhat on the principle of the pan used by gold-miners. Attached to the shaft of the discharge end of the mill is an arm which imparts a motion to this washer, the water slowly finding its way through the different compartments as shown in the illustration, and finally emerging into the tank through an outlet not shown. In this way all the metal is recovered.

In the mill shown in the illustration the washer is made with a steel bottom, the com-

partments being divided by wooden sections. As furnished to the trade this part of the machine will be made of steel throughout.

Modern Construction and Management of Cupolas.*

BY THOS. D. WEST.

The subject which I have chosen for this paper is one in which every foundryman, no matter what his specialty, should be interested. All founders possess more or less knowledge of cupolas and mixing irons. It is not a great many years since some would have us believe that the science of operating cupolas was vested in good and evil spirits, who could be brought into control according as the cupola man puckered his mouth and the wind blew; and woe be to him who dared to intimate that they were appliances which could be controlled by human intelligence. Progress has so changed all this that if success is not achieved, a cause and a remedy are sought for by the use of brains in applying the principles which underlie all such work. The better we understand these principles, the more capable are we to attain success in the management of cupolas.

A great many different designs of cupolas have been used. Europe without doubt has tried a greater number than America. I could spend the whole afternoon sketching and explaining the different kinds of cupolas that have been used. This would be of interest had they been a success. Nevertheless, to know the reason why any certain appliances have been set aside may often better emphasize the features which were found an improvement over the old.

There was a time within the memory of many when the McKenzie cupola was largely used. This, as some present will no doubt know, was brought in at the tuyeres, which were continuous. This contraction made the tuyere section much smaller than any other part of the cupola. These cupolas worked well for small heats, or those of one or two hours' duration. When running longer than this the area facing the tuyeres became chilled and bunged up readily, so that the blast could not enter in sufficient volume to support the combustion necessary to do good melting, and besides the cupola was often bunged up so badly as not only to stop all melting, but cause much extra expense to clean out ready for another heat.

The gradual enlargement of heats which founders have found necessary to supply the growing demand for castings and meet competition, has led to a study of the cupola question and resulted in gradual enlargement of the area fronting the tuyeres. These changes showed such improvement that it is rare today to find any using other than what may be called straight cupolas, it being understood that the melting zone will be larger than the portions below or above it. It may be that in very large cupolas or those more than 60 inches inside diameter they may be brought in slightly at the tuyeres with good results, in some cases. Instead of doing this with large cupolas, I prefer to use center blast, which we have had in use at our foundry for about six years, running heats from 60 to 100 tons.

Another improvement that has been made in the past few years lies in the increase of the height of the cupolas. Twelve to fifteen years ago if a charging door was six to nine feet above the tuyeres it was thought ample. It has been found very economical to increase the height of cupolas, as by so doing more heat is utilized in raising the temperature of the iron before it settles to the melting point. The Carnegie company has cupolas about 30 feet high to the charging portion. For long heats this is very desirable. Where heats are of only one or two hours' duration it is not so practical. Heights of twenty feet upward could be better utilized for light heats by having two charging doors and stagings. However, in heats ranging from one to three hours, the charging doors as a rule should be three and a half times as high above the bottom plate as the inside diameter of the cupola. Then again it is well to have a good height of stack and these are best built of the same diameter as the cupola. This plan gives the gases a better release and causes less destruction of the lining, besides making it more comfortable for men charging the stock.

The next question we will take up is the height and size of tuyeres. These are placed in cupolas all the way from 8 inches to 60 inches above the bottom plate and there are few things about a foundry so poorly designed for their work. One can find founders running very light heats for the capacity of their cupolas, having tuyeres from 20 to 30 inches high, while others are trying to run very heavy heats with tuyeres 8 to 12 inches high. I know there are those who advocate low tuyeres for

* From a paper read by the author at a meeting of the New England Foundrymen's Association, Boston, Mass.

all classes of castings or heats. I cannot believe that such persons have had any extended experience in running what are generally termed heavy work shop cupolas. I would like to watch a person trying to keep a low-tuyere cupola going for a whole day or week, as is often done with those having high tuyeres. Some founders think they have done well if they have run their cupola for two hours, and then have a clean bottom drop. The secret of being able to run long heats and have a clean drop lies in having tuyeres so high that they can not only hold what iron is necessary for a tap and which for some may range from one to ten tons, but also have a distance of 6 inches to 16 inches between the slag hole and the bottom of the tuyeres. This prevents the slag from approaching the level of the tuyeres sufficiently close to be cooled or chilled by the entrance of the cold blast, so that the slag can be kept in a very fluid state to flow freely out of the slag hole. By having a thin slag, the refuse which comes from the ash of the fuel, sand and rust of the iron, also the oxidation of the silicon and manganese, is prevented from accumulating in the cupola. Where this is accomplished and there is ample tuyere area, one may run cupolas over 30 inches inside diameter about as long as the lining will stand from being greatly impaired or burned out, and still have a clean bottom drop.

Where heats do not extend more than one to two hours, according to the size of the cupola, and the metal can be let run or tapped out at short intervals, it is not generally necessary to have tuyeres more than 12 to 18 inches above the bottom plate, and still have a clean bottom drop. Such low tuyeres for light heats save fuel and give hotter iron than high tuyeres. This is owing to the metal having to drop through less space to be cooled by temperature lower than that at the melting point. When cupolas from 24 to 60 inches or larger on the inside diameter have heats exceeding one to two hours' duration, it is generally necessary that they be designed to permit being slagged out, and in doing this, the greater space that can be left between the slag hole and tuyeres the cleaner and longer melting can be obtained.

The combined area of tuyeres should be about 25 per cent of the inside area of the average diameter. Up to about fifteen years ago tuyeres areas were, as a rule, too small for good work. There are a great many different forms of tuyeres, but founders have come to learn that it is not so much the form as it is having sufficient area evenly distributed. Some founders use upper tuyeres in the distribution of blast. These are very effective in saving fuel, increasing the speed of melting and assisting cupolas to run long heats. Their drawback lies in shortening the life of linings. On account of this some will not use them. Their saving of fuel is due to their admitting a supply of oxygen above the level of the bottom tuyeres, to unite with escaping carbonic oxide, and turn it more to carbonic acid, which is the form of gas obtained by thorough combustion. The truth of this is often exhibited where a flame can be seen started at the charging door or top of the stack by reason of a new supply of oxygen coming in contact with the carbonic oxide which is escaping out of the cupola.

In regard to the volume of blast, it can be said that all should be used that is practical for creating rapid combustion. Large tuyere area and strong blast gives the greater speed and economical melting, as a rule. Too much blast is evidenced by a decrease in speed, clogging of the cupola and increase in fuel. It requires for best results from 30,000 to 33,000 cubic feet or something like a ton and a quarter of air to melt one ton of iron.

The variation of moisture in the blast has much to do with causing irregularities so largely found in melting. This can be realized more fully when we consider that oxygen free in the air forms about one-fifth by volume or one-fourth by weight, the other ingredient being nitrogen, in contrast with moisture or water, which in weight is 88.9 of oxygen and 11.1 of hydrogen. Air can absorb a large quantity of water. In warm weather it contains a great deal more moisture than in cold weather. At ordinary temperatures, air can contain about 0.27 per cent of water, whereas at zero it can hold only about 0.04 per cent.

The effect of moisture in the air is well demonstrated in making iron at blast furnaces. In the months of June, July and August the extra moisture in the air may call for about a third more fuel and reduce the output about one-fourth from that which can be obtained in cold weather. Water containing as it does 88.9 of oxygen, one might think it would serve the same end as oxygen in the air. Were it not for the fact that water resists dissociation of its elements up to a temperature of 1,800 degrees Fahr. it would not be so injurious in blast. However, before the blast is raised to a temperature of 1,800 degrees, which

separates the hydrogen and oxygen of moisture, the latter absorbs much heat which means extra fuel.

It is generally conceded that no two heats in the same cupola will give like fluidity in the general management of cupolas. A study of the variations in the humidity and temperature of the atmosphere makes it possible to account for much of the irregularity noticeable in cupola practice and opens a field for the use of the hygrometer and thermometer, by any who desire the better to control the evils of daily changes in the temperature and humidity of the blast.

What Will Make Iron Wear — Like Iron?

I am looking for a little advice and hardly know where to go for it.

You see, a molder knows a whole lot about some things. He knows why a casting is bad and a whole lot of ways to make it bad, and why it is dirty on one side, and that the pattern-maker means to have some knobs to come out as holes and some just as knobs, even if he doesn't always know which mean knobs and which mean holes. He knows hard iron from soft and fine from coarse and a great deal more. There is just one trouble with the molder just now. He doesn't tell me what I want to know.

You see we made a nice new loose pulley and put it up for ourselves and I felt like a boy with a new pair of boots. We don't often have new things, you know.

In about two hours I came in and that pulley was howling and was all cut up and the shaft as well.

Jim, a man of wide experience and extensive traveling, had made it and put it up.

I thought he had forgotten to oil it, but he claimed it was not made of the correct kind of iron. Said we should use analyses of iron like Brown & Sharpe and Wm. Sellers and those other good firms and our pulleys would never act that way. Said their iron had chemicals in it. Couldn't say just what they were, you know. Took a man that got a salary to do that. Couldn't expect it from a man working for wages.

I am trying to find out something about it. Ben, he's our molder, you know, just gave me a pitying stare when I asked him, and when I pressed the matter, told me he could give me hard iron or soft iron, weak iron or strong iron, and tough iron or brittle iron. I want iron that will stand rubbing or at least I want to know the name of the chemical that will make it stand the most rubbing.

I have been reading and find that iron has carbon and graphite, silicon and manganese, sulphur and phosphorus, and dirt in it, but I can't find which is which, for wear.

I keep asking people and one man says combined carbon is the stuff, says it makes steel hard and we all know how it wears.

Another says graphite is it, says it's a natural lubricant and if you have enough you wouldn't need any oil. (I like oil, though, or grease.)

Another says sulphur is the only thing. He uses it in making bearing grease and in cooling hot boxes. And so it goes.

Will not some wise man among those who do get a salary or even higher up, take pity on a little job shop and let us into the secret.

Somehow the people that write the big books don't seem to know that lots of iron is strong and soft and all those qualities,, but some wears and some doesn't, and to the man making machinery wearing is often more important.

You see, the fellow that gets the stuff will come back and want it replaced. He seems to know all about it, and is just sure that the kind he got is very bad. Of course he always uses the best kind of oil and lots of it, but that iron was too soft for anything, could nearly cut it with a pocket knife.

Now, really, was that iron too soft or was it ill use that made it fail?

The next one that comes in, tells me his iron is too hard, that a soft greasy iron should be used, that hard irons are dry and harsh. Are they?

If a piece breaks, I can put in more iron and even with weak iron finally get it strong enough, but if I miss that *wear* chemical where am I?

This may be a matter that is all so plain in the big shops and to big people that it doesn't get mentioned, but to me it is serious.

When I make a steam cylinder or guides or frame or brace or hanger of cast iron, and after figuring out how big to make it, I multiply the answer by from six to fifteen as a factor of safety (or ignorance as some one calls it). I feel pretty safe, even if the iron does vary 25 per cent in strength, but when I make a bearing I look around at some other bearing that stands and try to get mine as big or bigger. I can't use a factor of safety of two even, as I really don't know where to start figuring.

Of course I can find in the books that a surface well lubricated with sperm oil will carry so much and with other oils so much. That is the oil, but what will a bearing do, that gets a little oil today, a little dirt tomorrow, a little tallow when it gets hot enough to melt it, a little oil on the outside of the box when the oil hole gets stopped up and between times just does the best it can.

I know that some of them cut worse than others. I know that machinery should not be run under such conditions, but it is, lots and lots of it, and some of it runs pretty well, too.

When I was very young, I thought I could reform the users. Now I would be satisfied if I could make what I do make in such a way as to stand the most abuse with the least damage and thus build up a great reputation for myself and bring in lots of work for the shop.

If the man that has the knowledge will print it, I will buy his book or if anyone knows the name of it, he will be conferring a great favor by speaking right out and telling who sells it.

This is a good country to test wear as the ordinary outfit for oiling is a pail and an empty tomato can, used with the engine in motion.

You can generally find the engine without much trouble when you go out to repair it, and once in a while the owner has used a hoe or piece of shingle to scrape it, and bring out the outlines, so different parts can be distinguished.

When they are brought to the shop, the youngest cub has his innings first, and if he is inclined to be a dude he doesn't stay long with us.

Some engines will run for years without being rebored, and some makes seem to be much better than others in this way.

As the same man often handles several makes it seems reasonable to think they get nearly the same lack of care and should show up about the same.

Without regard to anything but wear, what elements should be mixed with iron to give the best results, and how much of them?

While to the designer who can make all of his bearings so large that the bearing-pressure per inch is light, this may not appeal, but where one has to furnish new parts that have worn out, it is a little different or where a surface gets very warm owing to where it has to do its work, so that the oil will burn up or run off, he must supply parts that will do at least nearly as well as the original ones did; for it is a hopeless job to convince some men that any abuse could be worse than the usual conditions they had always supplied.

W. OSBORNE.

A Good Thing for Bench Molders.

Ever since bench molding came into use the rapid "snap" molder has shown a fondness for using his shovel handle as a pean rammer. One does not have far to seek for a reason for this when it is remembered how the saving

of every little move counts in the volume of work at the end of the day.

As the ordinary molder's shovel leaves the factory it is not in a very good condition to be used as a rammer. Its blunt handle will not fit the edge of the flask, as a pean rammer should, and to help things along the molder whittles away part of the handle. This is all right so far as the molder is concerned, but the life of the handle is thereby shortened fifty per cent and the life of the handle means the life of the shovel. It is very seldom in a foundry doing bench work that the shovels are worn out before being discarded for the want of a proper handle.

We show herewith an illustration of a shovel having a rubber pean rammer, which is attached to the grip of the shovel by a neat steel stamping.

The rammer attached to this shovel not only saves time for the molder by combining two tools in one, but also avoids unnecessary destruction of the ordinary shovel handle, and the possibility of delicate patterns being damaged as is the case when the common handle is used for this purpose.

Shovels equipped with this rammer are made in two grades. The "New Century" is a solid cast steel, socket strap shovel, with thorough-

ly seasoned smooth ash handles, and is a good tool throughout.

The "Pro-tek-tor" is a tempered cast steel tool of the highest grade, equipped with a choice selected handle, with straight grain and thoroughly dry.

These shovels have been carefully tested during the past few months by a number of the largest foundries, and the manufacturers, the Osborn Manufacturing Co., by whom this shovel was recently patented, report that they are now being finished in large quantities, many return orders being received.

Why Some Foundries Do Not Have Competent Foremen.

A short time ago there appeared in certain Trade Papers an advertisement for one of those very scarce men, a superintendent for a malleable shop, who thoroughly understood the malleable iron business from the core room to the shipping room.

The writer, thinking that this was an opportunity of a life-time, was foolish enough to answer this advertisement, when followed ten days of anxiety, and then a letter appeared from the advertiser which read something like this:

"Dear Sir:—We are looking for an A No. 1 malleable iron man. One who understands the business from start to finish. If you are a good core maker, and understand how to mix core sand, can mix iron and understand how to build and run an air furnace, take charge of and run the annealing room, and above all a first-class bench and floor molder, and understand how to run a malleable shop, we have a fine opening here, and would be willing to pay you $3.00 per day."

These people evidently do not know what a shop superintendent in a malleable shop means. One might possibly get along with a poor core maker, most any kind of molders, and a certain percentage of cheap help in every department, but if the superintendent is not above all else a first class man, if he does not know and thoroughly understand the proper gating of malleable castings, if he does not know a good core from a poor one, or how much the core makers should be paid for turning out certain cores, if when he sees a pattern he cannot name within one-tenth of a cent what a molder should receive for making it, if all sand piles are alike to him, if he can neither fire an air furnace, mix iron or suggest a remedy when heats are running high or dull, then he is not a cheap man, but an expensive luxury, something that only a very large malleable shop can afford.

The one in charge of a malleable shop should know where and how to gate, chill or feed a casting before experimenting and losing all the profits on a job. He should be able to give a molder the proper rigging for his job, and if he is not competent to make the job himself, this will be a hard matter for him to do. He should be able to go into the annealing room and pack a casting as it should be packed, run an annealing oven as it should be run, and finally, when the castings come out, he should know whether or not they are annealed, and if not, where the trouble lies.

If the superintendent of a malleable shop lacks energy or the ability, not only to attend to these little details, but also to direct the movements of all of those connected with the malleable shop, he has not the knowledge born of experience and failure must be expected, or at best, small profits.

WM. H. KING.

Syracuse, N. Y.

Anthracite Coal as a Cupola Fuel.

I have been much interested in the article appearing under the above title in the May number of THE FOUNDRY. My first experience in melting iron was in Canada in the sixties. I had a 24-inch cupola, and my work was stove plate and light castings in general. We had a fan blower, and had the very best success in melting with the best Lehigh coal, lump size. This coal cost us there and then $14 per ton, so of course we were careful in not wasting more than we had to. I do not agree with Mr. Kirk when he says that it does not pay to try to use the coal after it has been subjected to the heat. After dropping the bottom, I used to sprinkle water on the dump, and save all the coal that was not burned up. In the next day's heat in the last charge I would use this, and found that I could melt from 400 to 500 pounds of hot iron with a bushel of it.

Like Mr. Kirk, I have also found from experience that a broken size of coal is better than the lump. It is only within the past six or eight years that I have used coke. I find that I can melt iron faster by using a mixture of 25 per cent coke. I also find that when I do use coke, I have to reduce my blast, as, if I use the same speed of blower for coke that I do for Lehigh coal, I destroy the lining of my 24-inch cupola very rapidly, and have

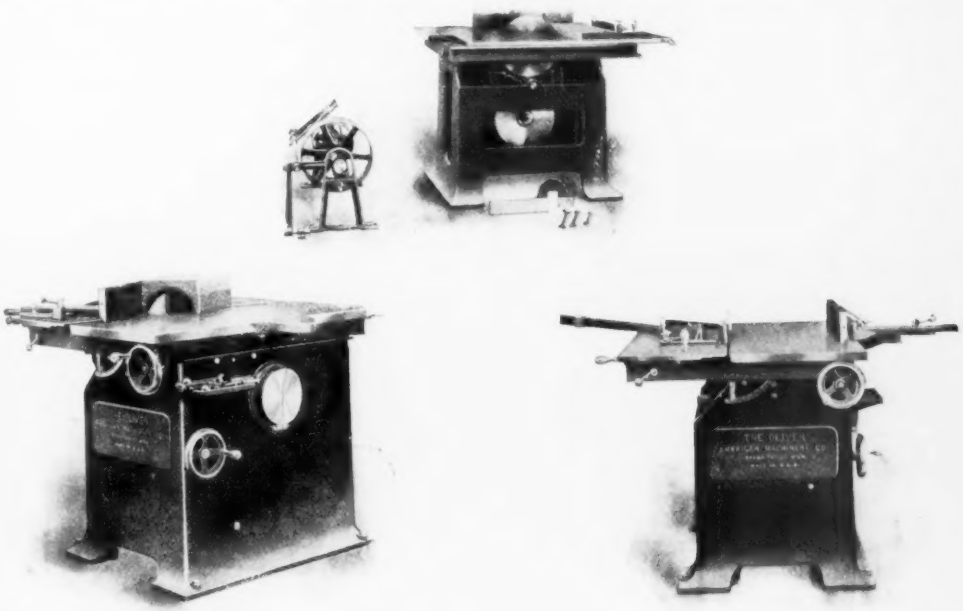
more slag. For hot iron give me good Lehigh coal. I have melted 50 per cent burnt iron in 3,000-pound heats, 30 per cent stove plate and 20 per cent Niagara pig iron, and made a good soft casting. The only trouble I have experienced is to obtain a fluid slag.

T. F. STIMPSON.

Hancock, N. Y.

The Oliver Universal Saw Bench.

We show herewith some illustrations of the Oliver Universal Saw Bench which has recently been placed on the market by the American Machinery Co. of Grand Rapids, Mich. The top is 36x44 inches divided into two sections, a sliding table 16 inches wide and the stationary part 20 inches wide, with a further extension of 8 inches to facilitate the use of the guide or fence over the entire width of the table.



THE OLIVER SAW BENCH.

The whole top may be tilted and operated in all its detail at any angle between 90 and 45 degrees by simply turning the hand wheel, when it is securely held in any position without tightening or loosening any bolts or nuts. Perfect alignment can always be maintained. A dial is provided which indicates the exact degree of pitch, and may be easily read while working the tilting device. The splitting fence takes up to 17 inches wide, adjusts from square to miter parallel with the saw, or can be set and firmly secured at an angle not in line with the saw on either the sliding table or stationary portion of the top by simply using one of its two plugs as a center pin. This permits the use of the periphery of the saw to cut semi-circular core boxes of any size.

These machines are built very substantial, and weigh complete 1,800 pounds.

Heavy Snowfall in Ohio.

The Silver foundry was closed down today owing to the pig iron being so deeply buried with snow. It will probably be a couple of days yet before work can be resumed.

Woodruff & Son's foundry is closed down today owing to inability to get the pig iron to the cupola on account of snow.—[Salem (Ohio) Herald.

In Chattanooga, Tenn., twenty of the leading merchants and business men have agreed to allow any of their employes who become students of the International Correspondence Schools, Scranton, Pa., five evenings a week without reduction of salary in order that they may devote this time to their studies. Employers generally recognize the importance of educating their men, and in a number of the largest industrial plants in this country arrangements have been made for the accommodation of employes who wish to study by mail.

The Delano Pulley Molding Machine.

Iron pulleys is one of the earliest forms of transmission machinery, and the molders and foundrymen have more ways of turning out these castings than any other form in which cast iron is made.

As molded by hand, the average pulley is not perfect, nor is this to be wondered at when we consider the conditions under which it is made. Take a ring pattern and yanking it up first on one side and then another, and then use arm cores, which in many cases are ill made, and adjusting the whole thing largely by guess work, may produce a casting which bears a great resemblance to a pulley, but it can in no way guarantee that symmetry which is so essential to this class of castings.

For many years E. A. Delano, 50-56 South Clinton St., Chicago, has made a specialty of building pulley molding machines which will mold pulleys from 3 to 72 inches in diameter,

THE DELANO PULLEY MOLDING MACHINE.

and any width of face with any weight of arm desired. Our illustration shows what is believed to be one of the largest pulley molding machines in use at the present time. It will mold pulleys from 62 to 72 inches in diameter with any width of face up to and including 36 inches. This machine was recently shipped to the E. P. Allis Co. of Milwaukee, Wis., and makes the eighth Delano pulley molding machine in use at the Allis works, molding pulleys from 6 to 72 inches in diameter.

We all know that when it comes to such castings as pulleys, that a molding machine will turn out more perfect work than the best molder, and turn out more of it. As far as reducing the cost of the molder is concerned, the Allis Co. say that these machines have enabled them to turn out pulleys at a reduction over hand methods of from 50 to 66 2-3 per cent, not to speak of the benefit derived from symmetrical and perfect castings.

In many parts of this country it is exceedingly annoying for manufacturers to have to send a long ways for machinery of this kind, and the foundryman who has a set of machines by which he can instantly supply what is needed will build up for himself a large trade. It is almost impossible to carry in stock the great variety of pulleys demanded, and the foundryman who can replace a casting on a few hours' notice will find his services in demand.

It is somewhat of a paradox that the largest manufacturer of wooden pulleys in the world has lately installed a complete outfit for making iron pulleys.

Among the Foundries.

The Chapman Valve Mfg. Co., Indian Orchard, Mass., manufacturers of valves and fire hydrants, is building a brick addition, 150x50 feet, for storage of castings, and a second story addition to the pattern storeroom.

Harry Gunther, who operates a foundry and machine shop at Owensboro, Ky., has started a similar plant at San Antonio, Texas.

Citizens of Oshkosh, Wis., are organizing a company for the manufacture of malleable iron castings. J. J. Stevenson, Elmer Leach and C. W. Davis are among those interested. Local manufacturers of wagons, carriages, pumps, logging tools and other products involving the use of malleable castings will be the principal stockholders.

The Dempster Mfg. Co., Des Moines, Iowa, will shortly increase its manufacturing capacity quite considerably. Several buildings are to be added to the plant, one of which will be used for a brass foundry.

The Keystone Car Wheel Co., Pittsburg, with works at Hays Station, has let the contract for a large increase to its foundry. The capacity, when completed, will be about 600 wheels per day, or larger than any wheel foundry east of Chicago. Although the company was only incorporated in June and began operations in September of last year, yet the success with which it has met and the demand created for its product has compelled the addition of machine shop and large addition to the foundry buildings, increased annealing room, etc.

The foundry and machine shop of McAddie & Co., at Cadillac, Mich., have been purchased by two brothers, Daniel S. and Frank Kysor. The former was for several years superintendent for William E. Hill & Co., Kalamazoo.

The Reading Foundry Co., Limited, Read-

ing, Pa., will shortly reorganize. A charter has been applied for, when in all probability the foundry will be started up.

The J. A. Oberhelman Foundry Co., recently incorporated, has succeeded to the jobbing foundry business of C. F. Thauwald & Co., Cincinnati, Ohio.

The large foundry of The Manufacturing Co., builders of railroad frogs, switches, crossings, etc., at Carlisle, Pa., which has been idle for four or five years, is being fitted up. John Hays is president and general manager, and F. A. Shaffner superintendent and foreman of shops.

The Ohio Pump & Brass Co. has purchased the plant of the Patton Mfg. Company, at Columbus, Ohio. It will manufacture a full line of steam, water and gas fittings, and make a specialty of hydraulic water lifts. They have a large foundry for brass, bronze and aluminum castings.

The Helmick Foundry & Machine Co. is erecting a new plant at Park and Eighth streets, Fairmont, W. Va. The main building will be 50x120 feet, with suitable adjoining buildings for the power plant, cupola, etc. All the latest appliances will be installed for the manufacture of self-oiling car wheels, mining tipple chutes, castings and for structural iron work. Captain N. D. Helmick will be general manager and E. E. Helmick will have charge of the works.

The Youngstown Engineering Co. is letting contracts for its new plant to be built at Youngstown, Ohio. It will include an open hearth steel casting plant. The contract for a good deal of the machinery has been given to the U. Baird Machinery Company of Pittsburg, and also to the American Tool Company, at Cincinnati, and it is expected to have the plant running in about 60 days.

The Butler Street Foundry & Iron Co., 3424 to 3428 Butler street, Chicago, is erecting a three-story addition, 25x100 feet, to their plant. The first floor will be utilized as an office, the second as a pattern room and the third floor as a store room. The foundry is to be extended over the space now occupied by the offices.

The Interstate Foundry Co., of Cleveland, is erecting at Thirty-sixth street and Western avenue, Chicago, a large iron foundry, where it will engage extensively in the making of special castings, such as sewing machine frames, etc.

The Central Foundry & Machine Co., Reading, Pa., recently incorporated, will occupy the old plant of the Reading Scale and Machine Co. A three-story and basement brick office and storehouse 30x40 feet will be erected, which will be equipped with an elevator and other conveniences. New machinery will be installed in the machine shops, the machines in the pattern shop improved, and the plant otherwise equipped with the latest appliances for the manufacture of castings, engines, boilers, scales, shafting, general mill supplies, etc. Levi M. Francis is president and Harry C. Urich general manager.

The Soule Steam Feed Works, Meridian, Miss., of which T. E. E. Bartlett has recently become secretary and general manager, will add a foundry to its plant.

The Greenwood Mfg. Co., of Connellsville, Pa., has applied for a charter and proposes to erect a plant near Connellsville, Pa., for the manufacture of mining machinery, engines, pumps and mine equipment generally.

A. H. Rawson and Axel Anderson, both formerly employed at the Winter Foundry & Machine Shop of Faribault, Minn., have formed a partnership under the firm name of Rawson & Anderson, and will operate a machine shop at the above city.

The business formerly conducted by M. Walker under the style of Fenton Iron Works, at Fenton, Mich., has been incorporated under the name of Walker Mfg. Co., with a paid up capital of $25,000. The new company will continue the manufacture of the Walker pumping engines and water works appliances as heretofore.

A. W. Rom, formerly superintendent of the foundry operated by James Frake, Chicago, and E. R. Klemm, proprietor of the Klemm Machine Works, 103 West Monroe street, Chicago, have formed a partnership under the firm name of A. W. Rom & Co., and will operate the O'Brien foundry at 772 to 776 Carroll avenue, Chicago. The foundry building is a comparatively new one, 50x75 feet, and two stories high. Land adjoining the plant has been purchased, and as soon as matters can be brought in shape additional buildings will be erected. New foundry equipment has been installed, and the firm start out with a number of orders and contracts on hand.

The R. M. Eddy Foundry Co., 53 to 57 Indiana street, Chicago, is erecting an office building on a lot adjoining their foundry. The building will be two stories high, 60x75 feet, and of brick. The foundry will be extended over the space formerly occupied by the office.

A. J. Doane has purchased the interest of the estate of the late Thomas E. Smith in the firm of Arnold & Co., iron founders and manufacturers of hardware specialties, Norwalk, Conn. Mr. Doane is now sole proprietor and will continue the business under the old name of Arnold & Co.

At a recent meeting of the directors of the Seaboard Steel Casting Co. the general officers of the company were authorized to proceed with the construction of a large new pattern warehouse and a commodious wharf at the plant. The business of this new plant has increased so rapidly that the question of pattern storage has become a serious one. It is the intention of the company to build a large brick building of improved construction, which may be added to as time requires it. The original structure will be about 60x100 feet in dimensions.

A. B. Day Foundry Co. has leased the foundry of the plant formerly known as the West Knoxville Mfg. Co., Knoxville, Tenn. Many improvements have been made and the foundry thoroughly equipped for the manufacture of high grade iron castings.

M. J. Morehouse, 288 La Salle street, Chicago, has completed plans for the construction of a large plant at Chicago Highlands, adjacent to the town of Barrington, Ill., for the American Malleable Castings Co. The buildings and plant will cost $50,000. The principal building will be one story, 560x110 feet, and will be subdivided into a foundry, 300x110; mill room, 40x110; annealing room, 200x110 feet, and charging platform, 20x110 feet. An office building, as well as a laboratory and drafting rooms, will be erected, the plans for which have not yet been made. There will also be built in the same connection sand sheds, coal storage sheds and a fireproof pattern building and vault.

Plans are in course of preparation for another extensive improvement to the Hickox-Mull Mfg. Co. foundry and machine works at Bowling Green, O.

The Brison Foundry, a new industry, will shortly commence operations at Reading, Pa.

A one-story foundry building covering 100x200 feet of ground is to be built at 938-944 S Lincoln street, Chicago, by Walter C. Newberry. It is to cost $22,000.

The Bullock Electric Mfg. Co., through its secretary, James Wilson Bullock, has acquired control of 15 acres of land directly opposite the present plant at Norwood, a suburb of Cincinnati, O. Upon this tract the Norwood Foundry Co. will erect a foundry building 200 feet long by 150 feet in width; a pattern storage house of fire proof construction, 50x150 feet, three stories high; and a modern office structure. All these buildings will be built of buff pressed brick with steel frames and trusses to conform to the present buildings of the Bullock Electric Mfg. Co. The foundry will be equipped with three electric cranes, the largest of which will have a capacity of fifty tons. The side bays, which will be 25 feet in width, will be served by hand traveling and jib cranes. The plant will be of the most modern character, and electricity will be used for power and lighting throughout. While this foundry will be operated under the name of the Norwood Foundry Co., it will serve primarily the needs of the Bullock Electric Mfg. Co. It will also be in position to handle outside orders. It will be under the direction of Messrs. Hoefinghoff & Laue, of Cincinnati.

The Eagle Brass Foundry located at Seattle, Washington, is building a large plant to take the place of the foundry recently destroyed by fire. The new building will be much larger than the old.

The plant of the John F. Riley Foundry & Machine Co. at Charleston, S. C., which was destroyed by fire several months ago, has been entirely rebuilt and placed in operation.

The Montpelier Foundry & Furnace Co. has been incorporated at Montpelier, Ohio, with a capital of $10,000.

James Barker, Founder and Machinist, at Second and Somerset streets, Philadelphia, will shortly remove his plant to larger quarters, having doubled his present capacity.

The A. T. Stewart Co. of Carnegie, Pa., has absorbed the Princess Plow Works at Canton, O. The Carnegie Co. purchased the patterns, trade marks, finished goods and raw material and will dismantle the works at Canton and remove the machinery to Carnegie.

The Moline Pump Co., Moline, Ill., will add to its business the manufacture of gas engines. The particular engine which it will build is the invention of one of its employees named J. A. Brown. It is of a new type, but has been the subject of exhaustive experiments for several months, and will be made in 2, 4 and 6-h. p. sizes. A two-story building, 33x58 feet, will shortly be erected to be used for this purpose.

E. Charboneau of the Twin City Iron Works, Hurley, Wis., contemplates the erection of a foundry and machine shop at Ashland, Wis.

The Quincy Foundry & Novelty Co., Quincy,

Ill., has increased its capital stock from $10,000 to $20,000.

Heck & Marwin will rebuild their foundry, recently burned, at Findlay, O.

The Crucible Steel Casting Co., of Milwaukee, Wis., has secured three acres of ground at Allisville, a suburb, where it will construct a large manufacturing plant. F. A. Lange is president of the company. C. F. Maynard, secretary.

James Haley is erecting a brass foundry, 35x 20 feet, on East Main street, Orange, Mass.

The Metal Castings Co., Springfield, Mass., which is capitalized at $150,000, has made a proposition to the Board of Trade of North Adams to locate its foundry in that city. The company is to manufacture castings by a patented process which it claims is as good and as cheap as brass. The officers are Edward P. Chapin, president; Arthur I. Nash, vice-president; W. Fred P. Fogg, treasurer; Frederick Carpenter, secretary; Moro D. Stebbins, superintendent.

The Columbus Forge & Foundry Co. of Columbus, O., will erect a new foundry building. It will be 50x115 feet in dimensions.

The Erie City Iron Works of Erie, Pa., will erect a large boiler plant, 550x125 feet, with an average height of 50 feet. The Cambria Iron & Steel Co. will furnish the structural material. This addition is necessary owing to the large amount of business this concern has on its books at present. This company has just completed an addition to its engine department, 150x250 feet.

The Hartley Boiler Works, Montgomery, Ala., are adding a foundry to their boiler plant. The building is 60x35 feet. The required machinery is of the latest pattern.

The Lawrenceville Bronze Co. of Pittsburg, is preparing to enlarge its plant, which plans when completed will more than double its present capacity. The changes contemplate the building of a 50x75 foot extension, fronting on Penn avenue, to be used as a foundry and furnace room, the erection of a three-ton furnace and the addition of a lot of new machinery. The plant at present employs about 40 men, and will be able under the new arrangement to turn out from 40,000 to 50,000 pounds of brass and bronze castings per day. All improvements will be completed by June 1, under the supervision of the company. The officers of the concern are Edward Kerr, president; W. R. Brown, superintendent, and George W. Gosser, secretary and treasurer.

One of the largest steel casting plants in the world will be built five miles below Woodbury, N. J., and close to the plant of the New York Shipbuilding Company. Henry C. Frick, Henry W. Mellon and Congressman Loudenslager engineered the deal. Henry G. Morse, of the shipbuilding company, in which Mr. Frick is a heavy stockholder, is also interested. The plant will be capable of producing the largest and heaviest forgings for transatlantic steamships, and the bulk of the output will be taken by the New York Shipbuilding Company. This concern has $10,000,000 in orders at present. Henry C. Frick is the guiding spirit of the project.

Graff & Co., Elizabeth, N. J., have bought a tract of land at Scranton, Pa., on which they will erect a large manufacturing plant. The business of the company is the manufacture of hot air furnaces, ranges, brick and fire place heaters, etc. They will erect two large buildings. The main foundry will be 415x149 feet. The pattern shop will be 90x60. The capital stock of the company is $100,000. Plans for the buildings are completed and the work of building the foundations has begun. It is expected that the plant will be put in operation during the summer.

The Girard Boiler & Mfg. Co., of Girard, O., has offered a site adjoining its plant for the erection of a machine shop and foundry. The enterprise will probably be undertaken by Frank Deemer, a practical machinist and foundryman, and a citizens' movement is on foot looking to the formation of a company.

The 20th Century Heating & Ventilating Co., of Akron, O., has been incorporated to extend the business of Clerkin & Maag, manufacturers of furnaces. The foundry of the latter company will be enlarged and the company will do a jobbing foundry business in addition to manufacturing its own castings.

Root Bros. Co., of Plymouth, O., are increasing their foundry capacity by an addition 40x100 feet.

The F. M. Prescott Steam Pump Co., Milwaukee, Wis., has purchased a site 485x250 feet at Wauwatosa, a suburb, on which it will erect a complete plant to be constructed of brick and steel and to comprise a foundry, machine shop, storehouse and power plant, all to be equipped with the latest appliances.

From present indications, operations will be commenced at the plant of the Gruson Iron Works at Eddystone, Pa., about June 1. The company will manufacture the coast defenses

known as Gruson rotating turrets. P. H. Griffin of Buffalo is the president of the new concern. The plant at Eddystone takes in 185 acres upon which eight buildings have already been erected. There are three railroads to ship over and there is a frontage of 1,000 feet on the channel side of the Delaware river. In addition to the buildings already up two are to be constructed, one 800x300 feet, and the other, an armor plate machine shop, 600x200 feet.

The Schill Bros. Co., of Crestline, O., manufacturer of the Schill furnaces and steel ranges, has purchased additional land recently and will build three important additions, one 50x120 feet and another 25x120 feet. Both will be three stories. The foundry will be enlarged also by an addition 70x100 feet. The new plant will be completed as rapidly as possible.

Work is progressing rapidly on the Pomona Foundry & Machine Co.'s plant at Pasadena, Cal. The new company has a capital of $50,000 and the works will be modern in every particular.

At the annual meeting of the Braddock Machine & Mfg. Co. of Braddock, Pa., plans were adopted for an extensive addition to the plant to cost $50,000. The company's increased business makes the addition necessary. The officers were re-elected. The company now employs 300 men.

The Globe Pattern Works Company, Indianapolis, Ind., recently acquired eleven acres of ground on the outskirts of Indianapolis, and is preparing to build wood and metal patterns, gas and gasoline engines, steam engines, and special machinery. The company is erecting a pattern shop and has plans prepared for the erection of a foundry building, 50x146, and a machine shop 40x146. The company expects to have the entire plant complete and ready for operation by September 1 and is in the market for radial drills and foundry equipment.

Fred E. Jones has purchased a half interest in the Jackson (Ohio) Foundry & Machine Co.

A. E. Menke has built a foundry at Fayetteville, Arkansas.

William and James Pettigrew of Ivanhoe, Va., have purchased the foundry at Everett, Pa., heretofore operated by Robb & Whisel.

The Jackson & Church Co. of Saginaw, Mich., will erect a new foundry building 50x110 feet in size.

The Acme Fence and Foundry Co. of New Albany, Ind., has been reorganized, the capital stock having been increased from $6,000 to $10,000, and the following officers elected: A. P. Hauss, president; T. M. Barbee, vice-president and general manager; R. C. Huncilman, secretary and treasurer.

The Wing & Stephens Co. of Little Rock, Ark., has lately removed its plant to new quarters. The officers are: C. E. Stephens, general manager; C. E. Stephens, Jr., secretary, and J. V. Stephens, superintendent.

The Utica (N. Y.) Brass Works has been incorporated by W. C. Williams, F. E. Howarth and J. W. Howarth.

The Whitney Car Wheel Co. of Philadelphia has been incorporated with a capital of $150,000 by Thomas B. Whitney, Joseph P. Mumford, Francis Schumann, John Thomas, T. F. Brooks, J. Lancaster Dailey, and William S. Darnel.

The Moore & White Co. of Philadelphia will build a 60x90-foot addition to its foundry.

The Lizzie Lowman Stove Foundry of Sheffield, Ala., has completed the foundations for a large addition to its establishment, which will be pushed to an early completion, when it will employ an additional force of sixteen molders and add three new patterns of stoves to its catalogue. The foundry is now shipping two carloads of stoves weekly.

The Northwestern Foundry & Supply Co. of Detroit, Mich., has been organized with a capital of $50,000. It has purchased the plant formerly operated by the Michigan Heater Co. and will convert the same into a very extensive jobbing foundry. Several additions and improvements are under consideration.

The Spaulding Mfg. Co., of Grinnell, Iowa, will shortly make several improvements in its foundry plant.

Pittsburg and McKeesport capitalists are interested in the formation of a new company which is to erect a foundry to cost $50,000 on a site recently purchased at McKeesport, Pa. Among those interested are W. F. McCrea, R. S. Harris and C. F. McCrea.

The Schwab Safe Co. of Fostoria, O., has been reorganized for the purpose of adding a stove foundry department, and the name of the concern has been changed to the Schwab Safe and Stove Works. The authorized capital of $50,000 is all paid in and the force employed will be increased to 50 skilled men. The officers of the reorganized company are: President, L. Schwab; vice-president, Frank R. Elbert; secretary and treasurer, E. E. Ervin.

Southern Foundry & Machine Co., Knoxville, Tenn., has been organized with a capital of

$10,000. The incorporators are F. D. Griffith, J. W. Crudington, W. Boright, W. F. Stamps, R. L. Moore and A. J. Winkle. Several improvements will be made in the plant they now occupy.

W. D. Combs and F. R. White will start a foundry and machine shop at Canon City, Col.

The Illinois Machine & Foundry Co. has been incorporated at Chicago by Josiah Cratty, William H. Duval and Edward J. Hamel. The capital stock is $50,000.

Axel Lindberg will shortly start up the old foundry at Lindsborg, Kansas.

The Goetz & Brada Mfg. Co. of Chicago has purchased a site at Chicago avenue and Sangamon street, upon which it will erect a large brass foundry.

The James Cooper Manufacturing Co. has begun the erection of a large new iron foundry at Lachine, Quebec, for the manufacture of mining machinery, to cost about $250,000. The new works will be operated exclusively for the manufacture of the necessary castings, to be used in the other workshops of the firm. It is the intention at first to employ about 300 men in the new works, but a much larger number will be required later on. The estimated cost of the new buildings and plant is about $250,000.

The Appleton Screen Plate Works of Appleton, Wis., is just starting a brass foundry department, which will make castings for its own use, and also brass and bronze castings for any purpose about paper and fibre making machinery. William Walker, lately of the Milwaukee Brass and Copper Works, is foreman.

The incorporation of the Crescent Foundry and Machine Co., of East St. Louis, Ill., is announced. The incorporators are Thomas R. Harris, P. J. Soucy, H. J. DeHaan and P. W. Abt. The capital stock is $15,000, and the new company will do a general foundry business, making a specialty of manufacturing and repairing machinery of all kinds.

The Waterbury-Farrel Foundry & Machine Co. of Waterbury, Conn., has awarded the contract for building an addition to its plant to cost $60,000.

J. P. Therrell of North Adams, Mass., will open up Hunter's old foundry in Edmund street and manufacture an improved grate for boilers, which he has just patented. Ten men will be employed.

John McEwing is preparing to start a foundry at Circleville, Ohio.

W. F. Mullica is making arrangements to start a foundry at Ortonville, Minn.

John Duer & Sons have opened a brass foundry at Vanderheyden and North First streets, Troy, N. Y.

Andrew Schmidt & Co., brass founders, of Winnipeg, Manitoba, are building a new plant.

The Wahle Foundry and Machine Co., of Davenport, Iowa, is rebuilding its plant and installing new machinery.

The Springfield (Ohio) Foundry Co. is making preparations to increase its capacity.

The Buckeye Foundry Co. has been organized at St. Paul, Minn. It will engage in the manufacture of stoves.

The National Machinery Company, Tiffin, Ohio, manufacturers of bolt, nut, wire, nail and special machinery, have purchased the property formerly occupied by the O'Brien Wagon Works, which were destroyed by fire. As soon as the ruins are cleared away work will be commenced on a large building to be used as an addition to the company's foundry, which will be equipped with modern and improved appliances for the expeditious and economical handling of work.

The Camden Anchor-Rockland Machine Company, Rockland, Maine, manufacturers of anchors, marine and stationary gasoline engines, etc., are erecting a one-story building, 100x40 feet, for a brass and iron foundry and boiler shop.

The Miller Mfg. Co., of Ellisville, Miss., has recently been incorporated by C. J. Miller, George Miller and E. W. Greeman and will build a new foundry and machine shop. The capital stock is $20,000.

The St. Louis Iron and Steel Foundry Co., St. Louis, who have been for some time investigating the subject of steel castings manufacture with a view to installing a plant, have finally decided to adopt the Tropenas process. In keeping with this decision, they are now remodeling a considerable part of the extensive foundry buildings occupied by them at Eighth and Hickory streets and making other preparations looking to the installation of two 5-ton Tropenas furnaces, together with suitable electric and compressed air equipments to give them a thoroughly up-to-date foundry for the production of a general line of steel castings for machinery. New columns, girders, etc., are being put in on the Eighth street side to provide proper support for electric traveling cranes and a truss roof, and a compressed air plant will be provided for cleaning castings, etc. The molding floor will be 178 by 40 feet, and the finished shop 122 by 40 feet, both on the Eighth street side, and both will be served by the electric cranes.

The Brillion (Wis.) Iron Works contemplates the enlargement of its foundry in the near future.

The Vancouver City Iron Works, Vancouver, B. C., will erect a foundry 100x80 feet, a machine shop 100x60 feet and a boiler shop 100x60 feet.

The Mingo Foundry & Machine Works of Mingo, W. Va., have just started operations in their plant.

The Toledo (Ohio) Stove Works will enlarge its plant. An addition 80x200 feet is projected.

Deaths.

Elijah C. Barton of the Gong Bell Mfg. Company, East Hampton, Conn., died of heart failure following an attack of the grip March 29. Mr. Barton was born October 25, 1836, in East Hampton and was one of a family of 12 children. In his youth Mr. Barton was employed in various bell factories, and in January, 1866, with E. G. Cone, H. H. Abbe and A. H. Conklin, formed the Gong Bell Mfg. Company. This partnership continued until the death of Mr. Cone in December, 1898, when, with N. N. Hill as the new partner, the company was reorganized. Mr. Barton belonged to the family of Bartons who are said to be pioneers in the manufacture of small bells in this country, and by whom the business of bell manufacturing in East Hampton was established.

Sylvester N. Leary, proprietor of the Columbia foundry at Brooklyn, N. Y., died at Atlantic City, April 20, aged 34.

John Bentley of Bentley & Jackson, Bury, Lancashire, England, died recently, aged 48.

Robert L. Stokes, president of the Fulton Foundry and Machine Works, Atlanta, Ga., died April 30 after a week's illness from pneumonia. He was 37 years of age.

William H. Burch, one of San Francisco's pioneer foundrymen, died at Haywards, Cal., recently.

Fires.

The Stover Mfg. Co. of Freeport, Ill., were visited by fire April 27, affecting their implement department only. The loss is estimated at from $30,000 to $40,000. The machinery and hardware departments of the company remained untouched, and we are advised that no interruption or delay in filling orders will occur.

The foundry and machine shop of Asa Snyder & Co., at Richmond, Va., were burned May 1st.

The foundry and warehouse at Jenkins & Lingle, Bellefonte, Pa., burned April 16. Loss estimated at $20,000.

The Industrial Iron Works of Omaha, Neb., were visited by fire April 30. The damage is nominal.

A fire starting in the vicinity of the cupola did some damage to the plant of the Reynolds-Chalou Foundry Co., Troy, N. Y., April 13.

Air Furnace Metal For Machinery Castings.

To the Editor:

I shall be glad to hear from any of your readers as to the use of air furnace iron for valve and heavy machinery castings. A. M.

We have asked Dr. Richard Moldenke, of New York, secretary of the American Foundrymen's Association for his views on this subject and have his reply as follows:

To the Editor:

I note briefly the following advantages and disadvantages of the employment of the air furnace in making large valve and machinery castings:

Advantages—1. A better grade of iron is secured, being really a gun metal. 2. Great bodies of iron available at one time. 3. The possibility of melting heavy scrap.

Disadvantages—1. More expensive than cupola iron. 2. Must be tapped and used as a whole and at one time, as a rule, unless specially arranged for to tap twice. 3. Requires loam or dry sand molds for good looking castings. 4. Addition of steel scrap to cupola metal gives good strong iron and green sand molds can be used.

So that, unless it is absolutely essential to have the highest grade of castings, the cupola is to be preferred. Where, however, the castings are to be used for important water works contracts or pumping machinery it is safest to use air furnace iron, no matter how dear.

New York City. R. MOLDENKE.

Chimmie Powers' Answers to Correspondents.

Young Journeyman: Kid Mehlig made de Fly Wheel yu speaks uv, it was so big around dat de two Cranes stood 'tween de arms. De fin on it weighed more den de castin' dat Jack Reeves made, and de risers on de rim wus de size uv Whiskey Barrells. He had Red Jack brought up frum Louisvill tu help him, but in castin' it one uv de covers blew off uv de risers, and de blaze dat come out set fire tu, an' burnt down de shop, and de Kid lost all his tools while Red got his eye brows

burnt off tryin' tu save his over Coat an Shoes. De metal in de rim never set fur two weeks an' de kid explained dis to a reporter by sayin' dat de coke bed gota fire an' kep' it melted dat long. Ed Ten Broeck lit de vents, and lotsa swell folks cum in Carriages tu see de Kid cast it.

Red McCue: You win; Sandy Knight never refused tu give Krebs a job, he told him tu geta Shovel an' clean up de gang way.

Buffalo, N. Y. Mr. Powers: I have a Card in the K. of L. and have another in the Locomotive Firemen's Order, am a member of the R. R. Trainmen's also, have some knowledge of the Foundry business, having worked at it off and on for about two years, could I get a Molder's Card, and how should I proceed? Yours V. T., JAS. CARTER.

You better back up a little, Jim, yuve nearly gota full hand now, an' at de rate yure goin' yule have a whole deck uv Cards. I kin see de Shop committee tackelin you, an' you runnin' over de bunch to get de right one.

O. N. E. (1) Break-shoe Bradley is not a Gold-bug even dough his teet is filled whit gold (2) De Molders believe in the molding of both metals, Iron and Steel, at de same ratio. (3) De first Stove Molder was deformed whit a hump on his back, an' all de fellers servin' der time usta think dey hadta ram like him, dats why dey ram in dat position.

Belleville, Ill., April 5, '01.

Mr. Powers, Dear Sir:

I placed an order for some casting recently in a Grey Iron Foundry, and was amazed when they were delivered to find that they were Blue, have I been imposed upon, or does this feature make any difference in the life or last qualities of the metal?

N. E. W. STYLES.

Sure; dey tought you wus green, an' give you a unferior quality, send dem back an' let on like you know it all. dey wouldn't last a week "less you kep" paintin' dem every day.

Paddy Clifford, Milwaukee, Wis.: (1) Yes: Anaconda Slim is a cracker jack uv a Star, he kin walk into most any shop an' pull off his Raglan an' go tu work whit out askin' fur a job, an' wen de office peopel find out hes dere, dey want him tu take charge right away, an' if he lays off a day, de head gazabow is out in his Buggy lookin' fur him. (2) Why don't yu try an' get Sport. McKinney he had sum experience at makin' cores. (3) Granite City is a Democratic Shop, an yu gota be a flyin' squirrell tu work dere.

Toledo, O. Mr. Powers: (1) Why do Molders travel so much? They are always going somewhere, and constantly talking about it. (2) Why are Molders so scarce just at present, and is it possible that this will be so through the coming summer? Y. V. T.,

A. T. ATWOOD.

(1) Dere feet gets itchey, an' a change uv scene, an' travel is de only known cure, sometimes dey don't have sand 'nough tu stick in one place long. (2) De scarseity is caused by Molders driftin' in to other professions, an' business, somes on de pleece force, somes runnin' sloons, (looka Rox Mehan fur instance) an' somes broke in to de law, an' Real Estate ranks, an' later on yure apt tu hear uv Rockeyfeller an' dat push bein' trun down by dem, yes dey'll be scarse dis summer 'cause de season opens putty soon at Atlantic City an' Rockaway beach. S. E. ATTLE.

Present and Future Chilled Cast Iron Car Wheels.

BY WILLIAM FAWCETT, ST. CHARLES, MO.

The superintendents of motive power and other railroad officials who have given only a passing thought to the manufacture of chilled cast iron car wheels cannot comprehend the responsibility involved in the management of a car wheel foundry. There is no material used in car construction that has to pass through such a severe and critical inspection as the chilled cast iron wheel of the present day. Before a freight car wheel is accepted or put into service each and every one is closely inspected and has to meet the following requirements, which form only a part of a late wheel specification of a prominent railroad:

All wheels are to be inspected at the works of the maker; all wheels offered for inspection must be arranged in rows, all wheels of the same date of casting being grouped together. They must, during inspection, receive three blows with a twelve-pound sledge at three different points on the inside of the flange between the brackets, and after a close inspection show no cracks, and be free from every visible foundry defect. The physical test which wheels are subjected to consists in the selection of two wheels at random by the railroad company's inspector from each fifty wheels, or fraction thereof of the same date of casting. These two wheels are then subjected, at the option of the inspector, to either one or the other of the following tests for physical strength:

The drop test is that the wheel must be

placed flange downward on an anvil block of not less than 1,700 pounds weight, having three supports not less than five inches wide for the flange of the wheel to rest upon. In this position it must be struck centrally upon the hub by a weight of 140 pounds falling from the height of 12 feet. The striking face of the weight must be flat, having a diameter of not less than seven inches. The wheel must stand 12 blows without breaking in two or more pieces. If it passes this test, and satisfactorily meets all the other requirements, and the other test wheel selected stands the thermal test, and both show the required depth of chill, the balance of the 50 wheels is accepted. If either of the two wheels fails in any of the requirements, the lot is rejected.

The thermal test is designed to guard against the failure of wheels from strains due to heat generated by the application of the brake shoe. This test calls for the wheel to be laid face up on a sand bed, and a channel way 1⅛ inches wide by four inches deep molded with sand around the wheel. The clean tread of the wheel must form one side of the channel way, and the flange the bottom. This channel way must be filled to the top with hot molten cast iron taken direct from the spout of the cupola in one ladle and poured direct from it at one point into the channel way. An examination of the wheel is then made after two minutes, and if it is found broken, or any crack appear in the plate extending through the thread, the 50 wheels represented by this test are rejected. As the quality of the metal and the depth of chill are further requirements all test wheels must be broken for examination. The metal in the plates must show a clean soft grey iron breaking with a ragged fracture. The depth of clean white iron must not exceed ⅞ of an inch, or less than ⅝ of an inch in the middle of the tread, and must not be more than ¾, or less than ½ inch in the throat; it must not show any clean white iron around the anchors or chaplets; or have a mottled appearance in any part of the wheel at a greater distance than 1½ inches from the throat and tread.

Specifications Do Not Insure Life and Mileage.

It is safe to assume that the wheel maker can easily meet the drop or thermal tests, and give the required depth of chill and also show the inspector a clean, soft grey iron plate in all test wheels when broken; but the life and mileage may still be unsatisfactory. It is not wisdom for the superintendents of motive power to arrogate to themselves the right of absolute dictation in having the plates of all wheels broken show a clean, soft grey iron, without any white or mottled appearance. It is well known to the progressive wheel manufacturer that a car wheel, to give six years' service under heavy loaded freight cars running at a high rate of speed, requires to be cast with a strong, mottled, hard, dense, close homogeneous chilling metal, which is known to them from long experience to have excellent qualities for wearing surfaces, and gives to the tread or chilled portion a close, dense-grained metal, possessing all the qualities of a steel-tired wheel. The manufacturers are obliged to live strictly up to the specifications, to have their product pass inspection and show a clean, soft grey metal plate, regardless of the consequences which are sure to follow.

Car wheels by the present method are cast from one ladle of molten metal, and there can be no dividing line drawn between the chilled tread and plates. The elements in the molten metal that give a soft grey metal plate enter into the chilled portion of the tread, and the ill effects of it can be readily traced to the limited mileage, thus accounting for the short life of cast iron wheels made in accordance with the railroad's own specifications. The slightest deviation from them would sacrifice a whole day's cast to the maker.

The Depth of Chill Requirement.

The lines are too closely drawn on the depth of chill. The difference between ⅝ and ⅞ of an inch makes too small limits to keep between, while at 1-32 of an inch above or below these figures the inspector rejects the lot. Some of these inspectors come clothed with authority to make it unpleasant for the wheel maker, and are at times very exacting in all the requirements asked for in the specifications, it being much easier for them to be critical than correct in such matters.

It may be asked why the railroad official should dictate to the wheel maker the exact depth of chill (no more or no less) and also demand clean, soft grey plates, and then specify six years' service guarantee with every wheel. Would it not be wisdom for them to leave the depth of chill and the softness of the plates to the discretion of the wheel manufacturer, or else make this uncalled for inspection an absolute mileage guarantee, releasing the manufacturer from all further responsibility. After a lot of wheels has satisfactorily passed the above inspection, the spec-

ifications call for a six years' service guarantee with all freight car wheels, and two years' service with all passenger, engine and tender truck wheels. They further require the manufacturer to replace (without expense) every wheel not filling the above mileage guarantee, and all those that are removed from service on account of failures due to any inherent defect, with a new wheel made in accordance with the specifications, and that replaced wheels must be furnished subject to the same inspection as the original wheel. It is also to be understood that any defect in wheels which calls for removal (with a very few exceptions) shall be considered inherent defects. It is therefore a well understood fact that cast iron wheels must possess several distinct features before they are ever accepted or put into service:

First, they must satisfactorily pass a severe and critical inspection and be free from every visible foundry defect.

Second, they must have strength and tenacity enough to stand the drop test, and show physical strength enough to be above danger line.

Third, they must be free from all shrinkage strains to withstand the thermal test, which suddenly heats up the tread unevenly to a black red heat, leaving the plates and center cold.

Fourth, the wheel must have a certain depth of chill (no more and no less) and must show clean, soft grey plates.

Inspectors should accept the wheels without reference to accident or fracture when living up to the specifications. They should not lose sight of common sense.

Large Percentage of Short-Lived Wheels.

It has been the writer's custom for years when having old car wheels unloaded at the works, to note down the year in which they were made and the maker's name. In connection with the works is a well-equipped physical laboratory where all incoming material is carefully tested, especially old car wheels. Each day a few wheels are selected from the products of the different makers and tested for our own private information. When broken a piece of each wheel, with the shop number attached, is then sent to our chemical laboratory, where a careful analysis is made and recorded against that wheel and number. By this method we keep in close touch with what other wheel makers are doing, and by a careful study of their shortcomings, we are able to correct our own. In a lot of 9,500 old car wheels already received this year from ten different railroads, 7 east and 3 west of the Mississippi river, we found the product of 12 wheel foundries with the following results:

6 per cent of them were made in 1895.
9 per cent of them were made in 1896.
11 per cent of them were made in 1897.
39 per cent of them were made in 1898.
19 per cent of them were made in 1899.
9 per cent of them were made in 1900.

Seven per cent were scattered back to 1880. Some few were made in the present year, the maker's name and supposed cause of removal being withheld.

The gradual increase in weight and size of freight cars has during the past five years been so great, we do not believe it is wisdom for the wheel manufacturers to guarantee six years' service with wheels placed under heavy box cars running at a high rate of speed night and day, Sundays and holidays, making on an average of 2,800 miles per month, loaded both ways to their full capacity. The chilled cast iron car wheel of the present time seems to be the target upon which all the big and little guns of railroads are trained; but they must not expect too much of wheels made strictly to their own specifications, and cast from the best brand of charcoal iron by men of integrity and capacity who have been conducting their business for over half a century, and have faithfully earned a reputation for excellence of their product and are today an honor to the iron industry. The wheel maker is not at his best when his ambition is tied hand and foot by a too closely worded wheel specification, which should be corrected.

Air Furnace Metal and Chemical Analysis.

It is safe to predict that before many years of the new century have passed, all chilled cast iron car wheels will be manufactured in geographical centers where the resources, adaptability and advantages are present for that class of work. There seems to be a growing demand among the superintendents of motive power of some of the leading railroads for a better and more uniform grade of wheels than they have been receiving of late years. But before they can accomplish this, they will have to order all their wheels to be strictly made of a certain chemical composition, and specify that they must be cast from an open-hearth gas furnace metal. There is no doubt that a plant capable of turning out car wheels with any chemical analysis called for is practicable and highly desirable. This method of order-

ing wheels will give the railroads just such a wheel as they order and pay for, it will also relieve the manufacturer from a great deal of trouble and responsibility, and exclude all elaborate deductions of the wheel inspector, as everything will be governed by their chemical analysis. If railroads insist upon this method of ordering wheels, they will have to specify a definite chemical composition, and abolish the physical tests and mileage guarantee; and it will only take the wheel manufacturer a short time to prepare himself with the means to furnish just such a wheel as they may see proper to order.

The writer has been asked by several railroad officials if wheel makers were prepared through their chemical laboratories to furnish wheels of any definite chemical composition that they may see proper to order in their wheel specifications. I must admit that they are not by their present methods of casting wheels. Carbon, sulphur and phosphorus will be the determining factors, and these three elements are unmanageable in a cupola. It is hard to realize the revolution that this development will cause in the car wheel industry. It not only calls for new plants, but a radical change in existing ones, but in either case it cannot help but be beneficial in the end.

Car-Wheel Foundry for Continuous Melting.

I have before me the working plans, and all the details of an ideal car wheel foundry with a capacity of 1,200 car wheels per day of 24 hours. The building is designed with the view of continuous molding, pouring and putting the wheels into annealing pits. In planning the works, special attention was given to all the necessary conveniences for handling the material cheaply from the yard to the finished product, it being the object to make this plant up to date in every particular detail, embodying all the latest and best improvements known.

Without going into the cost and size of buildings I will give a few of the general arrangements to enable the progressive wheel maker to see some of the advantages it possesses over the present methods of molding wheels in the forenoon and pouring them by the same men in the afternoon from each successive tap from a cupola with variable results as to uniformity, depth of chill and physical qualities. In connection with the molding department in this ideal plant are three open-hearth gas furnaces and four modern cupolas of the required capacity. It is not proposed that these will be in use all the time, but only at stated intervals. It is not intended to take the molten metal direct from the blast furnace, but to go into the open market and buy a suitable quality of pig metal from different localities, and after sampling it carefully by competent men, charge it into the cupolas in various proportions and relative quantities. It would be melted in the best possible condition and poured into the open-hearth furnaces and kept there under a proper heat temperature until all the objectionable elements mentioned in the wheel specifications are taken out of the metal, and those required added and chemically united. The open-hearth gas furnaces are intended to be of the latest and best designs and to be under the direction of a metallurgist of ability, who fully understands the chemical composition of the metal wanted to fill any required analysis called for with absolute and unerring accuracy. He will also fully understand the nature and the effect that each element will have separately on the product, and the combined influence of all the elements when chemically united.

After the molten metal has remained in the open-hearth furnace until it is known to be of the proper temperature and chemical composition, it is then drawn from the furnace in a proper sized ladle and removed from all further heat influence; the wheels are then poured from it at the same temperature, thus giving to the product an even shrinkage, a uniform depth of chill and physical strength far beyond the requirements for ordinary usage. There will be cast on each wheeel a spur about 1½ inches high. The wheel inspector on looking over each day's cast for foundry defects, will break off as many spurs as he may deem proper, and send them to the railroad's chemical laboratory where a careful analysis will be made for all the elements, and if they all come within the lines drawn in the wheel specifications, that day's cast will be accepted. If any of the elements are on the outside of those lines, that day's cast will be rejected.

It is the intention in this ideal plant to have the molding carried on continuously by three gangs of molders and their helpers, divided off into three 8-hour shifts. Ten molders and their helpers start in on a shift of eight hours, each molder putting up five wheels per hour; after then come at stated intervals a gang of trained men under the management of a man of executive ability, whose duty it will be to attend strictly to pouring the wheels, taking them out of the chills and putting them into the annealing pits, preparing the sand, and

leaving everything necessary in good shape for the next shift of molders. These men being trained in only one special branch of the business, and doing only that one thing, will soon learn to do it quickly, cheaply, and accurately.

The successful wheel maker of the future will be prepared to make wheels of any chemical composition desired. He will be able to control the carbon, sulphur and phosphorus, and keep them within very narrow limits. When these three elements can be regulated to a nicety, the wheels will be more uniform, their life more satisfactory, and the physical strength increased far above all future requirements, the depth and quality of the chill regulated to an absolute certainty and the wearing qualities of the tread greatly prolonged.

CAST IRON NOTES.

Devoted to inquiries from Practical Foundrymen on the subject of Melting and Using Cast Iron. Address all inquiries to W. J. KEEP, care of The Foundry.

Shrinkage and Strength of Cast Iron.

Not long ago a user of mechanical analysis told me that he had for some time been making quite large castings for one of his customers. Several had broken in use and he wished to find a cause. He had kept a record of the shrinkage and strength of a one-half inch square testbar each day. He had looked over the records and found that the transverse strength had been very uniform at about 450 lbs. Could there have been anything wrong with such records? I asked how his shrinkage had run and his answer was "We have a record each day of the shrinkage but have not paid much attention to that." I then stated: *High strength and high shrinkage of a one-half inch square bar shows very strong, large castings, but high strength and low shrinkage show very weak, large castings* but strong small castings. He examined his records and while .160 inch per foot was what he intended he found that on several days the shrinkage was as low as .118 and that the weak castings were made on those days. Since then he watches his shrinkage (chemical composition) as well as strength. High shrinkage means low silicon and close grain; low shrinkage means high silicon and coarse grain for large castings.

How to Make Soft Cast Iron.

"I enclose proportions of pig irons used with 22½ per cent silicon iron in our mixture. We can drill about 150 holes with a 5-16 inch twist drill running 660 revolutions per minute before sharpening, through a casting 5/8 inch deep and ¾ inch diameter. The iron is run into very thin hardware castings. Can you name a mixture that will make soft castings? When we anneal the castings we can drill about 300 holes before sharpening."

Answer. As annealing is a very inexpensive treatment and is always sure to make soft castings, it would seem best to prepare the castings in that way. Pack the castings with wood shavings in cast iron pots or with the charcoal from previous annealings, or even with ordinary parting sand. Heat to a bright red heat which takes about twelve hours and let cool off in about twelve hours.

I do not like to give names of pig irons because the name does not indicate the quality. Iron that is hard can be made in the same furnace from the same mixtures that make soft iron if the furnace is hotter. Pig iron having the most combined carbon, which generally means low silicon, will make hard castings. Pig iron having about 3.00 per cent silicon ought to make soft castings for you.

You do not give the grade numbers of any of your pig irons or the name of the silicon iron you use. This looks a little as though you were not very familiar with the influence of silicon on the grade of pig iron or castings. You name those irons made in Alabama which are all quite generally used for thin castings, but you may have received iron containing less than 2.00 per cent silicon. You should have purchased No. 1 soft which should contain over 3 per cent silicon and then you would need very little silicon iron.

Founders in your part of the country are not generally familiar with the use of silicon iron and consequently are not aware that with low carbon, silicon iron will often fail to soften other iron, and that a casting made of pig iron having low silicon with the silicon added by a silicon iron, will never be as soft as when made from pig containing the same silicon as the casting. If the silicon iron was a good softener, 22 per cent is not unusual with founders accustomed to it, but ordinarily it is safer to use less. The question is one of chemical composition and a founder should know approximately what silicon his pig iron contains.

A founder must also use some method for determining whether the casting needs more or less silicon if he expects satisfactory results. There is no other way to make good castings.

Satisfactory castings from ½ inch to 1 inch thick can be made from almost any mixture of gray iron, but to make a heavy casting on the one hand, or light hardware casting on the other, requires considerable skill and the above-mentioned knowledge.

Pig iron containing near 3.00 per cent silicon need not be a high-priced iron and a little experiment will show which irons available in your market will make the softest castings. Softness is not necessarily dependent upon chemical composition and there is always a difference in the softness of irons having the same composition. For your thin castings it is safer to select pig iron having an open grain, but be sure the silicon is along towards 3.00 per cent.

You say that you use a twist 3-16 inch drill at 660 revolutions and make a hole ⅝ inch deep. Such a drill has a very thin and weak cutting edge and if you sharpen on a dry wheel you will find that the extreme edge is blue. This drawing of the temper by grinding causes the edge to blunt soon after it enters the casting even if the casting is soft. Grind the drills on a wet stone. At such a rapid motion the chips are very hot and if the drill is vertical and enters the top of the casting the cutting edge of the drill is packed in chips that are nearly red hot which will certainly draw the temper of the drill. Entering the drill horizontally is a little better. The best results are obtained with a vertical drill entering the under side of the casting in which case each chip falls away from the edge. With a drill entering from below a straight fluted drill will do better work as it has a stronger cutting edge.

Cracking of Water Jackets.

Answering a question in the May issue, in the original letter it was mentioned that the discarded jackets from smelters were used as scrap and it was stated that jackets made by some makers did not crack and it was asked if the wrought scrap used by such makers prevented cracking.

It was stated that wrought scrap added to the mixture caused blowholes. It was also stated that the scrap from old jackets contained considerable sulphur. The fact that similar jackets made by makers remote from the smelter did not crack suggests that they would not be able to use the sulphurous scrap and that it would be wise to discontinue its use by founders near the smelter.

By using a small amount of pure aluminum in the ladle with 10 per cent steel scrap, blowholes will disappear. Twenty per cent steel would probably be the limit and the fuel must be increased to make it hot enough to pour. Changing the patterns to make all corners curved would diminish liability to cracks.

The only way to get rid of the sulphur that is in smelter scrap is to remelt it and pour it into pigs. A little ferro-manganese and silicon iron added will help drive out the sulphur and make the resulting pigs fit for ordinary castings, but it would be safer not to use it at any time for water jackets. You must remember that such sulphurous scrap has very great shrinkage when remelted and the addition of steel scrap increases the shrinkage of the castings.

A Good Cone Pulley Pattern.

The molding of cone pulleys has always given more or less trouble, since when the mold is parted, if the pattern is allowed to stay in the drag, the small draft on the pattern will tear the sand off the cope and a great deal of patching becomes necessary. On the other hand, if the pattern is lifted with the cope, the pattern will tear the drag portion of the mold, and the result is the same,—patching must be done. Not only is the time lost in patching a cone pulley mold to be considered, but the fact that the casting is not perfect is of far more consequence.

I will describe how to make a cone pulley pattern which will work almost to perfection. Take the cone pulley pattern you now have and make two castings. Leave the hub off the outside of one casting and off the inside of the other one. Leave core prints on both.

After having made these two castings we will proceed to convert them into one for use as a pattern. Let us say that each casting is one-half inch thick. We will take the pulley which we want for the outside part of the pattern and dress it off on the outside enough to draw well; then we will machine the inside of the same casting until it is only one-fourth inch thick. This pattern has no hub on the inside. We will then take the other casting and dress the inside so it will draw well, and then machine off the outside until it is one-fourth inch thick, when one casting will slip into the other one, and the two together form a perfect pattern for a cone pulley.

The advantage of this construction is plain to any man who has had to make cone pulleys. One part of the pattern can be lifted with the

cope and the other left in the drag, when each can be rapped and drawn separately, leaving a clean and perfect mold.

ED. KEMMERLE.

The Newton Disaster.

At the steel foundry of the Steel Co. of Scotland, Ltd., Newton, near Glasgow, Scotland, there recently occurred an explosion which resulted in the death of two men and the maiming of two others. A casting weighing 33 tons was being poured in a pit in the floor, and the explosion threw the molten metal all over the foundry. The glass in the roof was all broken, and complete disaster prevailed for a time.

The theory is advanced that there was an accumulation of gas underneath the mold, or that dampness was found in some parts of same. The disaster has caused a great deal of talk in the foundries of Scotland as to its exact cause. To practical molders the explanation of dampness does not appeal with a very great force, as this will not cause a sudden explosion except at the moment of casting, when it may be caused by the formation of condensed steam lying on the face of the mold. The bringing into contact of the two forces of fire and water will cause an explosion, but this will not account for the Newton disaster for while the mold will probably be injured and the casting a loss, yet the force exerted will not be sufficient to burst the binding bars and practically wreck a shop as in this case.

I believe the cause must be looked for in some other direction, and while I am actually not able to say or name its exact origin, yet I should like to draw attention to the method of manipulating cinder beds, which in some foundries at least is not conducive to safe work. As a general rule a cinder bed is laid down in a foundry in what the foreman believes is the most convenient place, and the general idea prevails that this cinder bed can remain there forever without the slightest attention. This is a mistake, however.

A cinder bed is employed to carry away the gases which are forced from the mold at the moment of casting. The vent pipes are the outlet by which the gases may leave the bed and escape into the air. But what would happen if a molder should be foolish enough to cast the job on the top of a cinder bed without putting in vent pipes, or if he used vent pipes which were too small to carry off the gases?

In casting large jobs I have seen the flame from the vents go out, and the next minute the moulder would grab up a handful of straw or a piece of rag and stuff it into the vent pipe as if his life depended upon making the latter air tight. I remember once asking a molder why he was in such a hurry to block up the outlet of his vent pipes, and he replied that as the gas had all passed away there was no need of keeping the pipes open. As a matter of fact, however, the gas had not all passed away. It had merely ceased to come in sufficient volume to ignite on reaching the air. The result of blocking the vent pipes was simply to hold the gases in the cinder bed until the next job was cast, as the bed was not disturbed.

This is a dangerous proceeding, as the following experience will show. In 1891 I was employed in a foundry in the east end of Glasgow, where a great deal of heavy dry sand and green sand work was done. The floor was honey-combed with cinder beds, and the vent pipes had been put in in most cases without any regard to the amount of gas to be carried off. Everything went all right for a considerable time, as there was always a bed being put in higher or lower to meet the requirements of different castings, but there came a time when for three months no fresh cinder beds were put in.

The gases had gathered in the beds until it was possible when a job was cast to light not only the vent pipes of that particular mold, but also the vent pipes from adjoining beds. Alongside the wall a beam 36 feet long was being made, and it was arranged to cast it on a Friday. On the preceding Thursday a large rolling mill check and a punching machine frame, or, as they are called in this part of the country, a "Bear," were cast, both of these molds being situated alongside the mold for the beam and but a few feet away. When the beam was cast there took place a most remarkable eruption of molten iron it has ever been my lot to see. From the in-gates and flow-gates the metal spouted in furious streams, setting the roof afire and turning the shop into a miniature inferno.

When the iron had subsided at each of the gates there appeared a blue flame about three feet high, blowing furiously as if acted on by a fan. The whole of the shop's crew was immediately converted into a fire brigade to save the roof from flames, and after a short battle this was accomplished. The next day every one in the shop from the core boy to the cupola man had an idea as to what had gone wrong. Molders' conventions were held every noon

hour, the general opinion being that there had been something in the mold. Exactly what this something was nobody seemed to know. One man assured me that the iron had got into the bed through a vent hole, but I have seen iron in a cinder bed before and since that occurrence, but I never saw it cause such a rumpus as on that day.

The amount of scrap which was left of the casting was lifted out, and the cinder bed relaid. When the next casting was made a few days later the question was asked why that one did not blow up, as it had the same kind of cinder bed and the same sized vent pipe and the same distance between the mold and the bed. After a few days' discussion the whole occurrence was relegated to the long list of unsolved shop problems. My theory of the trouble is that the gases from the two jobs cast the previous day had forced their way into the bed underneath the beam mold. As the vent pipes from these jobs were not large enough, and as the vent pipes from the bed under the beam were stuffed tight, the gas lay in the cinder bed underneath the beam until it was cast, when the gases from this mold would be discharged into a bed which was already filled. The gases in these beds would then be compressed, and on being heated would expand, throwing up the bottom of the bed and causing an upheaval of the iron mentioned.

Might not these same conditions have caused the Newton disaster? I am convinced that the cause of this lies near here at any rate. Look after your cinder beds, and do not be afraid to put in large vent pipes, and do not keep them stuffed all the time, for if the gas does not go through the vent pipes it will get through the mold, although it may not be in sufficient quantities to cause an explosion. A very little gas in the mold will cause scabbing on the bottom, blowing at the gates and blow holes in the body of the casting.

A. C. MILLER.

Johnstone, Scotland.

Notes On Foundry Practice.*

BY EDWARD B. GILMOUR.

By correctly knowing the results of combining the different elements which enter into a mixture, and having experience, through practice, the founder of today is able to intelligently mix his iron to suit various requirements in every particular, and not trust to chance, as was formerly the case.

*Paper read before the Foundrymen's Association.

Foundry management is now becoming a science and therefore he who directs the foundry must learn to understand the science of foundry practice or he will, in the near future, be seriously handicapped. At first sight, in looking over the analyses of pig irons and noting the ratio of the different elements which are in combination therein, the percentages of these elements seem so small that they do not appear worthy of consideration and should not affect the casting. If you compare the analyses of the different forms of iron you will see how little carbon it requires to change iron into steel, and it is only when you get a correct knowledge of the effect of various percentages of the elements in iron that you will be able to bring your experiments to a successful termination and not trust to chance or be imposed upon by every agent who comes along to sell pig iron. For castings requiring a special mixture of metal, such as cylinders, it is impossible to use what is termed scrap, as its composition is so variable that you do not know what you may expect to turn out.

Pure iron is of no use for commercial purposes, it is too soft and very difficult to melt; the iron that is used for foundry purposes is easily melted, as it is an alloy of a number of elements. Foundry irons are gray or mottled, and are divided into grades; and are numbered according to the quality as shown by the fracture, but with the advancement which is going on at the present time these numbers are gradually being abandoned and iron is ordered by chemical analysis to better suit requirements.

The principal and most effective element other than the iron that we have to deal with in cast iron is carbon.

Carbon.

The various percentages of carbon in iron determines the quality of the metal, whether it is cast iron, wrought iron or steel. Carbon is a tasteless and odorless body and is practically infusible; it exists in three forms, two of which are crystalline (diamond and graphite), and one amorphous (charcoal). For our present purpose we have only to consider it as it exists in combination with iron, which is in two distinct forms, viz., a graphitic and combined carbon. When it is in the graphitic state the cast iron is soft and easily fusible; it enters to the extent of 2-4.5 per cent, and in steel from .07 to 1.35 per cent. In wrought iron it is in many cases hardly perceptible.

There is no strict scientific dividing line whereby we may be able to judge when the sample has passed into steel, cast iron, or wrought iron, so that these terms have really only a commercial meaning which is determined by the amount of carbon present and the mode of manufacture. This is the element which most of all determines the strength of the metal. Graphitic carbon is always present in iron in a mechanical form, and is easily distinguished from the other form, which is in the combined state. This combined carbon is known to exist in several conditions, but there has not been any good method for separating them devised as yet.

Silicon.

The next important element which we have to consider is silicon, by a judicious use of which the founder may change the combined carbon to the graphitic, or vice versa, as he requires. When carbon has all become graphitic the further addition of silicon has a hardening effect. Silicon is not a softener of iron, nor is it a lessener of shrinkage, but through its action on carbon and only for a given range does it produce these effects. The loss of silicon in remelting in the cupola is not heavy, and cast iron which contains just enough silicon to prevent hardness and give a solid casting is the best composition to use. If strength be more important than softness we can leave the greatest amount safely possible of the carbon in the combined state, without, however, causing the iron to be too brittle.

Silicon being introduced into carbid of iron will throw out graphite, but if you have manganese carbids or titanium carbids present silicon will not be as effective. Silicon combines very readily with iron, but for foundry purposes from 1 to 3 per cent is the range, according to the class of work in hand, the thicker the casting the less of it being required.

Manganese.

Manganese alloys with iron to an unlimited extent. Beyond hardening it has no very detrimental effect upon the metal, but in many cases it is even beneficial by making iron readily susceptible to chill and close in the grain, and assists in eliminating blow-holes. Care must be taken in using this element, as it increases shrinkage, and if the design of the work is not in accordance with the laws of crystallization it will cause the casting to crack very readily. One good feature of this element is that it removes sulphur to a great extent and thus prevents red-shortness. The percentage of manganese is reduced very heavily in remelting in the cupola, so that about .8 per cent of it in the original pig for heavy castings would be about right.

Phosphorus.

Phosphorus weakens iron, more particularly when it reaches 4 or 5 per cent. It is very beneficial in stove irons when about 1 per cent. It reduces shrinkage. High phosphorus irons should be poured at a lower temperature as it renders the metal very fluid, everything else being normal. Phosphorus causes cold-shortness or brittleness when cold.

Sulphur.

This non-metallic element combines with iron very readily at low temperature. It is undoubtedly the most injurious element that we have to contend with in foundry mixtures, and causes iron to be weak. It also makes iron white and hard. Sulphur is not readily removed from the iron in remelting, but it is found that the temperature of the cupola has an effect on the percentage of sulphur in the iron. At high temperatures the sulphur will tend to go into the slag, as there is not so great an affinity between iron and sulphur under these conditions, and the iron becomes better. If at any time you have to stop the blast or reduce the pressure of the wind in your cupola while melting it will reduce the temperature, and, consequently, the sulphur of the coke will unite with the iron more readily. When this element is present in iron it increases the combined carbon and affects the crystallization somewhat. In buying iron you sometimes get iron high in silicon, high in sulphur, high in combined carbon and low in total carbon, the iron showing a very good fracture in the pig but if cast in a chill mold a sulphur chill, independent of the silicon, will quickly show up, indicating that this iron is not suited for very light castings or castings which are to be machined. Again, if you put iron into the cupola which is comparatively free from sulphur and do not melt it very hot it will absorb the sulphur from the fuel and your castings will be high in sulphur. High sulphur castings are filled with blow-holes and not easily machined, and when the molten iron comes in contact with the damp sand a chill and excessive shrinkage will result. If your know that your iron is

all right before melting and have trouble with your castings, what you want to do is increase the temperature in your cupola, and not try to produce such phenomenal results of melting at a ratio of 17 to 1, as has been claimed, but never got with good results. From 8 or 10 to 1 is right. This same fact applies to the steel foundries, as they will try to reduce the cost of their irons in the cupola, trusting to their converters to bring the steel out all right.

Two Views of Hardening Copper.

Much has been written about the hardening of copper, and we herewith append two articles on this subject, the first one appearing in the "American Machinist" of Feb. 7th, the other in the "Mechanical World" of Feb. 8th. The article in the first-named paper reads:

It is believed that some ancients had a process of hardening copper so that it could be used for some of the purposes for which we now use steel. As we have the steel, it is not easy to see why we should want the hard copper, especially as there is not the slightest presumption that copper was ever hardened and tempered as hard or as satisfactorily as steel now is. Nevertheless, the search for the process seems to be kept up in the intervals of rest between the perpetual-motion schemes, and occasionally we hear that it has been rediscovered or reinvented. A correspondent kindly sends us a clipping from a Chicago daily, which, stripped of its sensational headlines, reads, in part, as follows:

"Two Covington (Ky.) men, Daniel E. Connors, ex-city engineer, and Orville Bagby, have received a patent on a process for hardening copper. The metal in its raw state is formed into the shapes desired. It is then immersed in a chemical solution which removes all impurities. Then it is immersed in liquid air and frozen to a temperature of from 224 to 312 degrees below zero, which freezes the molecules. The metal then assumes a white color and is very brittle. In this condition it is plunged into a white heat of great intensity and allowed to remain till the copper assumes its original color. The process is then complete. The metal can be hardened to any degree required, but cannot again be melted."

The following is the essential portion of the specification of the patent above referred to:

"In hardening copper we first clean and anneal it by heating it to a red heat and plunging it into cold acidulated water or brine. After such treatment the copper should be laid aside, preferably for at least twenty-four hours. If then necessary, this process of cleaning and annealing it may be repeated. We then subject the metal to as low a temperature as possible, at least as low as 50 degrees below zero Fahr. To this end it may be placed in a mixture of salt, ice, and liquid ammonia or cooled in any other familiar way; but preferably we cool it by immersing it in liquid air, as thereby a lower temperature may be obtained than can be obtained in any other convenient manner. This cooling is continued until the metal has been cooled as much as possible and until it has been given full opportunity to contract. The metal is then withdrawn from the cooling bath and is heated immediately and as rapidly as possible. We have found that it may be heated most rapidly and conveniently by passing an electric current through it by means of an electric forge, furnace, or any other well-known electrical heating apparatus suitable for the purpose. The heating is continued until the metal acquires a temperature of at least 1,000 degrees Fahr., and preferably until it acquires a bluish cast, but not until the metal becomes red hot. When thus heated, it is laid aside and allowed to cool gradually, after which it may be finished as desired. The success of this process depends largely upon first cooling the metal to a very low temperature and then raising its temperature very quickly to the point desired. If the heating be too slow, the desired hardening may not be produced at all and if produced may not be as complete as if the heat were applied more rapidly. We have found that this treatment increases very materially the tensile strength and hardness of copper, and also its stiffness."

The invention involved in this case must have been largely employed in convincing the examiner that the copper could be heated to "at least 1,000 degrees" without becoming red hot. As to the hardness produced, we have simply the very mild words of the specification as above quoted. No specimens were submitted with the application. We must caution our readers that whoever soaks copper in liquid air, and then rapidly heats it to a temperature of at least 1,000 degrees Fahr., without getting it red hot, becomes an infringer of this patent, and weapons of copper tempered by the process will hardly avail to defend him.

In the "Mechanical World," Walter J. May says:

The question of hardening copper for va-

rious purposes is often mooted, but beyond a certain point of hardness it is difficult to see what advantage can be derived, as copper is too expensive for use as tools, and usually is too brittle also. Steel can be handled and worked better than copper for most tools, and would not be more than £25 per ton for good bars, when bought in bulk, while copper could not come in at such a price. Not that copper cannot be hardened—the writer makes knife blades, chisels, and similar articles at times—and many things made from it which are usually made from steel, but they are not wanted commercially. The only uses to which hardened copper could be put, looking at the matter from a practical point of view, would be in the casting of valve seatings and the like, provided the cost could be kept below that of gun metal, and that non-porous castings were made. Of course, valve seatings would not be the only things made, but this particular use suggests itself for mention. In many foundries copper, when cast, is always porous; but this need not be the case if the metal is properly treated. This is a point which, however, appears to limit the use of copper for many purposes, and whether in a soft or hardened state, this metal could be used with advantage if the castings were sound, and it is rather to the obtaining of sound castings that attention should be paid.

The writer has found in casting soft copper, that if some manganese chloride be used, say from 3 oz. to 1 lb. to 1 cwt. of molten copper, according to its quality, stirring the chloride in before the crucible is removed from the fire, and allowing the fumes to pass off before lifting from the furnace, sound castings result. Of course, large runners and heads are necessary, and feeding may be required, but otherwise the casting is as for gun metal. The cost of manganese chloride in 1 cwt. lots would be about 17s. 6d. and carriage, or, say, under 3d. per pound, so that the cost would not be an excessive one.

In hardening copper either manganese oxide or phosphorus can be used, the former being the safest; but if the presence of a small amount of tin would not be objectionable, then phosphor tin can be added, thus making a form of phosphor bronze, being careful to use tin holding the highest phosphorus content available. The copper thus treated will be hard, but not sufficiently so as to make cutting tools, although well hardened for most practical purposes.

In using the manganese oxide, the copper, free from lead or silver, is reduced to a fluid state at as low a temperature as possible, from 1 to 6 per cent of the oxide well stirred in, and the temperature of the metal raised for about half an hour, when, after skimming thoroughly, it can be poured. In the writer's trials the copper thus treated became quite hard, but with the hardness its ductility diminished, and in a case where about 25 per cent of oxide was worked in, the metal was practically as brittle as cast iron.

A few trials with ferro-manganese (80 per cent) gave fair results in the way of increased hardness, some iron alloying in, but the metal had to be cast in vertical bars to allow of the excess of iron coming to the top. Taken from a commercial standpoint, the working would not be a great success, as a lot of copper would be lost with the iron which rises from the alloy.

In using phosphorus, the copper is melted, and the phosphorus added in small quantities—a matter which needs the greatest care. Of course, the copper bath is kept at as low a temperature as possible while the phosphorus is being added, and a pair of tongs with long reins are used for its introduction; but as only from 8 oz. to 1 lb. has to be added to each 1 cwt. of copper, the process is not a long one.

Another method of hardening which causes extreme hardness, although the metal is porous unless cast in well-dried molds faced with plumbago, is as follows: Intimately mix together, in fine powder, 4 lbs. soda phosphate, 1 lb. ammonia sulphate, ½ lb. soda carbonate, and ¼ lb. finely-ground chalk, being very careful that everything is perfectly dry. Take about 6 oz. of this to each 1 cwt. of copper, and stir into the copper just before taking the crucible from the fire, being careful to let the fumes go up the chimney. In this case, probably a small amount of sodium, phosphorus, and sulphur will be combined with the copper, but it makes it extremely hard, and at the same time it is not brittle, inasmuch as sheets ⅜ in. thick can be bent to right angles.

With phosphor bronzes, copper, tin, and phosphorus—previously alloyed with the tin—in varying proportions are used, the copper being melted and the tin added and well stirred in. This makes a hard and tough bronze, and for many things is better than bronzes of copper and tin only. Care is necessary to have the right proportions, as a matter of course, and it is better to have the phosphor-tin ready

made, but bought under analysis, than to trouble about making it.

In all cases where manganese or phosphorus is being dealt with, the greatest care should be taken not to inhale the fumes, and it is always better to add such things while the crucibles are in the fire, so that the fumes may pass up the chimney. Some care is also needed in dealing with chlorides, as the gases are very unpleasant, if not actually poisonous, and should not be absorbed if it can be avoided.

Whether it would pay anyone to make hardened copper a specialty is an open question, but certainly it can be hardened quite easily. Simple bronzes or gun metals, however, in the writer's opinion quite cover the ground so far as utility is concerned.

The Trials of a Foundry Foreman.

A company is formed to go into the business of brass founding. The leading spirit in the enterprise has discovered a new alloy of brass or bronze, or aluminum, or a new method of making solid copper castings, which he thinks is going to revolutionize the whole industry. They advertise for a foundry foreman, and ultimately decide upon a man, whom they engage and proceed to imbue with a portion of their enthusiasm, by telling him all about the wonderful properties of the metal they have discovered, how it has been tested and tried, and found far superior to all competitors, and consequently has a wide range of application, which will ensure for them an extensive business provided they can turn out the castings successfully.

We will suppose the new foreman is a thoroughly practical man of wide experience. His experience will have taught him that there are certain alloys that present insuperable difficulties to the founder, but he is naturally hopeful, and in view of the fact that some castings have been made in this particular metal, trusts that if any difficulties present themselves, he will be able to surmount them, either by devising methods of casting or modifying the alloy. He therefore, enters into the business of equipping the shop, with an enthusiasm that keeps him working early and late, doing constantly more than one man's share of the hard work incident to getting out the castings. He lays out the shop, giving the carpenters drawings and directions for making the molding tubs, core-benches, shelvings, pattern racks, etc., superintends and assists in the laying of the bricks which form the casting floor, builds the flue, and designs and lines up the furnaces, and even spends his own money in car fare traveling around the city interviewing supply men, in order to obtain the best materials in the way of sand, flasks, furnace tools, etc., at the lowest possible figures. In the natural course of events, the new firm finds itself in readiness to commence molding and casting. A few trial orders are turned out, and then work comes in with a rush, for one of the shareholders is out on the road, ready, like Don Quixote, to tilt at anything, and people with castings to make are not slow to take advantage of the fact that here they can get them made much cheaper and as good as anywhere, for the new firm is desirous of making its name synonymous with quality and is determined to turn out the best of work and the best of metal. The new alloy is lost sight of for a while. When they get thoroughly started will be time enough to turn their attention to that; meanwhile they are exceedingly busy. After a while they begin to figure and the result is startling. They are losing money and lots of it. They try to raise their prices and the customers naturally resist, saying they would never have transferred their work to them unless they could get it made cheaper than they were formerly doing. The truth is the new firm has been slashing prices, not willfully, but through ignorance. The partners had neglected to take the pains to post themselves in advance and when bidding for work had named a price merely as a feeler, which may have been high or low, but was objected to by the desired customer on general principles. They would then ask the customer what he had been paying; he named a figure; they thought they must underbid that, so they got the work. The customer chuckled, the new firm got busy and hired more molders. So far it has been good for the customers and some few molders. After failing to increase the price of their work, the management turn to the foreman. He is made acquainted with the fact that the business is not paying, and it is evident to him that he is, to a certain extent held responsible. He suggests using cheaper alloys. The advice is followed, scrap is used and the thing continues to run on. The manager, with a praiseworthy determination to discover whether there is any money in the business or not, institutes a system of "red tape," the cost of which more than counterbalances any advantage that may have been gained by the introduction of cheaper alloys.

Each morning every molder is given a printed slip on which an attempt is made to keep track of every pattern he is working on and at night time he must count up his work and record it. This may be a good thing, but it costs money in molders' time, and the time of the man who makes out the slips. When the castings are cut off they must be weighed and each molder credited with the number and weight of his good and bad castings. This keeps another man busy counting and weighing and keeping each man's work separate. Then each individual heat of metal must be weighed and recorded before going into the crucible, and again weighed when the castings come out of the sand, in order to find out the loss in melting, and the result is never satisfactory, on account of the metal spilled in pouring and the temporary loss due to what adheres to the sides of the crucible. So, as far as practical results are concerned, this is all labor lost. Then the coke used must be weighed and tab kept on the crucibles. No wonder the laborers are kept busy and are to be seen going around the shop with a pencil stuck up under their caps, and a medical institute memorandum book in their hands keeping track, in their clumsy laborious way, of all the weighing and counting that must be done. The molders can get no help when they need it and must fetch and carry and help each other weigh and dump their own molds and "shovel in" and sieve their sand alone. No wonder they make less molds, for laboring work is more tiring than molding, for they are less used to it, and the more tired they become the slower they will mold, however willing they may be. The manager cannot see things in this light, however, but he can see he is not getting so much work turned out, and is not slow to ask the foreman the cause, who attempts to explain, but is met by the statement that he is too easy on the men; they are not working sufficiently hard, sometimes they are even seen away from their work. So the foreman has no alternative but to speak to the men. He does so with a heavy heart, for he understands the conditions and knows they have done their best. On their part the men are indignant, they have an abiding sense of injury, they cannot do better, for, handicapped by the laboring work, they have had to keep constantly working at pressure, in order to make a "showing" with their molds. So they blame the foreman, become dissatisfied and careless and the thing gets worse.

The manager now resolves to look after the shop more himself. Although he has no practical knowledge of the business, he thinks he knows how things should be done. He talks to the molders, shows them their bad work, tells them how he thinks it ought to be made, and suggests a "way." The molders, on their side, make excuses—the metal was too hot or too cold, it contained iron, or aluminum, or the sand is not good. One or two of them think they can see their foreman's finish, and perhaps they can get his job. So they throw out hints reflecting on his ability. The manager pretends to take no notice, but still such hints repeatedly thrown out and constantly growing bolder, taken into consideration with the fact that the business is evidently going wrong, probably turn the scale and the manager resolves to make a change. The foreman by this time is a thoroughly disgusted and discouraged man. He has lost the confidence of the men, and knows it, and the manager has interfered with his duties to such an extent that he possesses only the shadow of authority, as even the laying out of the work, and the distribution of patterns is his prerogative no longer, for the manager has considerately taken this out of his hands and even blunderingly figures out the heats for the furnaceman. The foreman can do nothing to put things right, even if he had the power, for he has not the time, because he has been given patterns and he must pound sand all day, just like the other molders (this is an actual occurrence). So he is not surprised when, a week or so later, the manager calls him to one side and gently and kindly, with many regrets, informs him that the stockholders have considered it advisable to make a change, etc., etc., and he is let out into the cold and a new man assumes command in the shop that he has taken such care and pains to fit up.

And this is the reward that a foreman can expect in a majority of cases when he takes charge of a new shop. He feels an injured man, but he has no redress. All he can hope for is that in the eternal fitness of things, he may sometime attain another foremanship, stepping into a berth that some other man has prepared, even as he prepared this one for his successor.—*C. Vickers in American Machinist.*

What the Molder Has To Do.

Some time ago the question was asked why there are no inventors among foundrymen and molders. Thinking of what molders have de-

vised to enable them to successfully manipulate so fragile a material as that of a sand mold, and of the constant care to be exercised when constructing a mold, or, what is the same, seeing that others do not become careless or overdo things, I send you a little list of a number of original tricks that the foundryman is daily called upon to practice or to plan for:

1. To make lathe-bed castings of various lengths from the same pattern.

2. To separate the cheek of a mold or the core box of an ogee lathe-bed.

3. To increase the width of face of pulleys, spur gears, etc.

4. To increase the width of face of an oval armed gear and have the arms in the middle of the rim.

5. To cast a worm without longitudinal joint or seam.

6. In casting a kettle to increase the inner depth and thicken the bottom.

7. To cast two, three or four-bladed propeller wheels with pattern of one blade.

8. To weld cast iron or brass; to cast trunnions on cannon, teeth on gears, etc.

9. To make composition castings 12 feet long or so in a 7-foot flask.

10. To increase or decrease the length, to widen or contract a mold.

11. To cast a long, heavy, chunky piece with a 1-inch hole clear through it.

12. To take off a thin pattern of irregular form from a block with beads and curving upon it.

13. To reverse a pattern from convex to concave.

14. To arrange iron core arbors and flasks that thin pipe can be made with green sand cores and no chaplets.

15. To plan to pour 12 or 14 tons or more of metal into one casting and have but a 5 and 6 ton ladle to do it with.

16. To get a pattern out of the sand where back draft is all the draft that has been given.

17. To mend up the wreck such patterns create, and bring shape and symmetry out of the evident chaos.

18. To correct or counteract tendencies of crooking.

19. To prevent cracking; to relieve as far as possible all internal stresses.

20. To split hubs, rims, etc., of driving wheels; hubs and rims of pulleys, gears, etc.

The above are a few of the problems that constitute sappers, as it were, of the foundryman's font of original thought. Be it remembered that each day brings to notice some problem as above mentioned, but differing with kaleidoscopic variation from preceding ones. What served as a safe road to follow yesterday may require a somewhat different course today. In addition to these frequently occurring calls upon his ingenuity and judgment is the narrow margin between success and failure that he is ever standing upon. It would be strange indeed if he did not become, at least as others think, conservative, disposed to leave well enough alone. The foundryman's unrest by day in the shop unfits him for mental exertion at home. The tricks of the trade I have mentioned require keen consideration when put into practice, and often result in evidence of true genius, seldom known or appreciated outside the walls of the foundry.—*L. C. Jewett in American Machinist.*

Personal.

Owing to the determination of the United States Steel Corporation to concentrate all operating departments of the constituent plants at Pittsburg, Charles M. Jarvis, vice-president, in charge of the operating department, of the American Bridge Company, has resigned, as Mr. Jarvis does not care to change his residence from New England.

Thomas Burke, who for years has had charge of the brass foundry at the General Fire Extinguisher Co.'s plant at Warren, O., expects to operate a brass foundry at Niles, O., for a new company.

James H. Manning, formerly master mechanic of the Union Pacific R. R. Co., at Cheyenne, Wyo., has been appointed western manager of the Standard Pneumatic Tool Co., with offices at San Francisco, Cal., where a complete line of their "Little Giant" pneumatic tools and appliances will be carried in stock, in order to supply the rapidly increasing demand for these machines upon the Pacific coast expeditiously.

For the convenience of customers and on account of constantly-increasing business Mr. A. Asher of New York, dealer in blowers and other machinery, has removed his offices to the Liberty Building, 123 Liberty, corner Greenwich street. Mr. Asher makes a specialty of rotary pressure and fan blowers, dealing in all makes and putting them in condition for satisfactory service.

B. W. Grist has resigned his position as superintendent of the American Steel Casting Co.'s plant at Alliance Ohio. He is succeeded by Rodney C. Miller.